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*Hunter's "Centipede"
—page 113*



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Number 3

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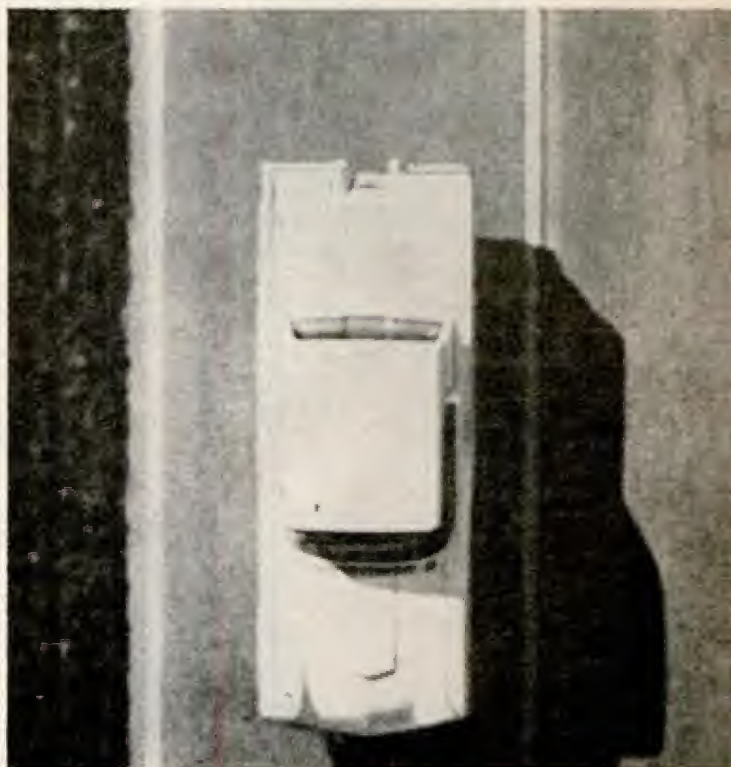
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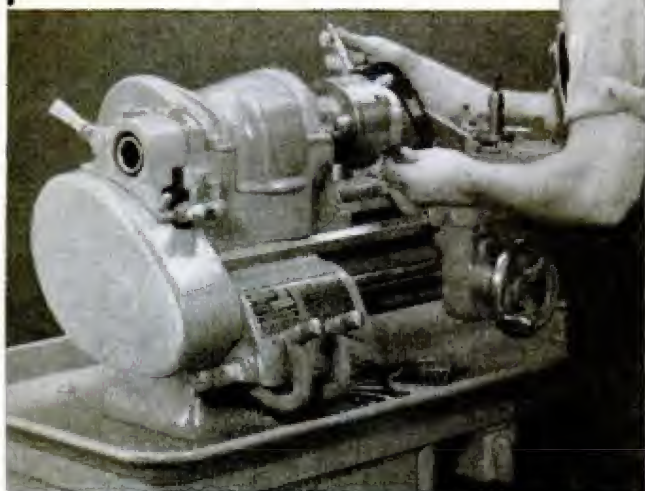


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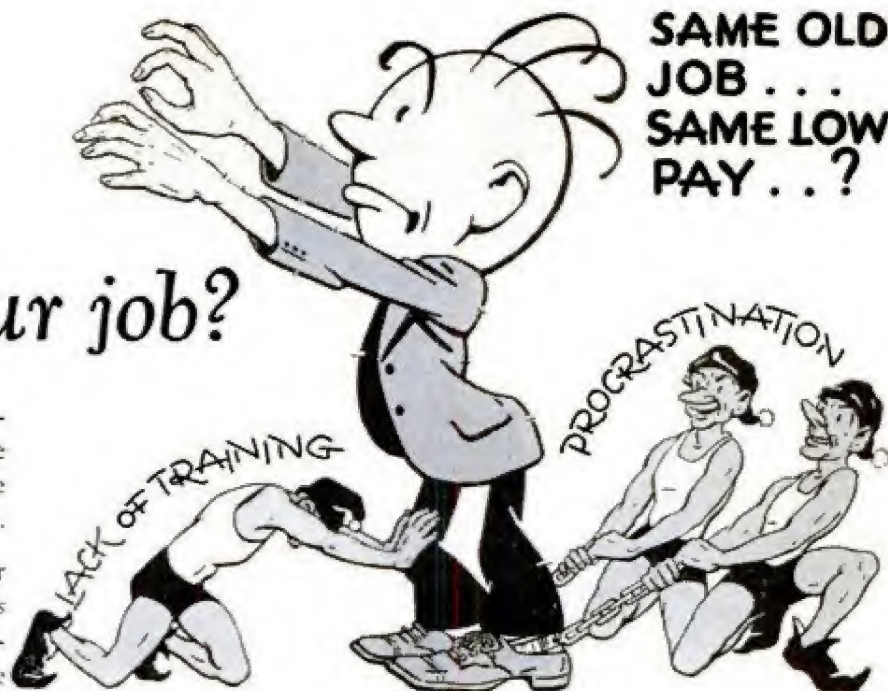
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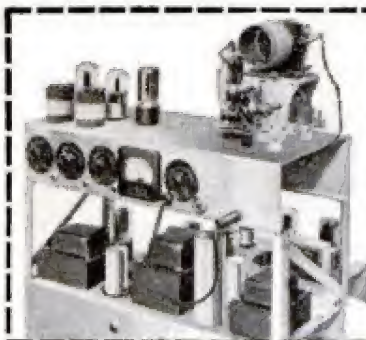
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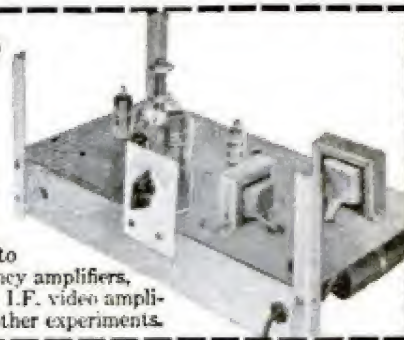


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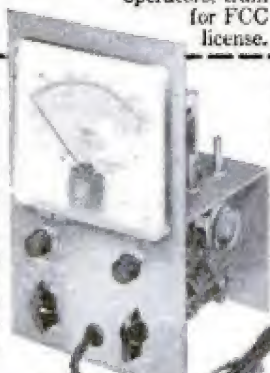
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"We have an appliance store with our Radio and TV servicing, and get TV repairs. During my Army service, NRI training helped get me a top rated job." W. M. WEIDNER, Fairfax, South Dakota.



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Over the Editor's Desk



THE FIRST BOOK published by *Popular Mechanics* was the 1904 edition of *Shop Notes*. Thus, it seems fitting that the first book to appear under our new annuals program should be the 1961 *PM Workshop Annual*, incorporating *Shop Notes* and another old favorite, *What to Make*. The *Workshop Annual* is at your newsstand now, and we think you'll like it.

Incidentally, future annuals will cover Electronics (October), Hot Rods (November), Science (January), Cars (February), Boating (March) and Homeowners (April). All will have cover designs resembling that of *Popular Mechanics*, so you shouldn't have any trouble finding them on the newsstand.

☆☆☆

Credit Is Due:

Through an oversight the source of the information contained in the article "Sunglasses for Your Windows" (May 1960) was not mentioned. Anyone interested in tinting the windows of their home should write to Transparent Glass Coating Co., 533 North La Cienega Blvd., Los Angeles 48, Calif.

☆☆☆

To the Editor:

There is only one such conveyance in all the world. It is 17 years old, built in 1943. The originator and designer was the late Mr. Edward C. Hammond of Auburndale, Mass. He built the Weep during his retirement and it afforded him much pleasure to build and drive it.

The Weep is an ingenious vehicle with an assemblage of parts from 16 different automobiles, a mowing machine, a tractor and an auto trailer. Many of the parts have been in existence for over 30 years and come from cars which were manufactured from 1927 to 1939. It is a rugged worker and thrives on a minimum of gasoline. The Weep is registered as a 1943 Hammond #1 Weep—Open Runabout Scootmobile.

This little car is equipped with 4.00 x 8.00 tires on four tractor wheels; 1939 Plymouth, two-wheel service brakes and a 1929 Ford hand brake. It sports two very large headlights from a 1927 Cadillac and a tail-light from a 1929 Model-A Ford.

A 1939 Willys-Jeep four-cylinder engine is the power plant, with electricity supplied by a large Buick battery. A clever master

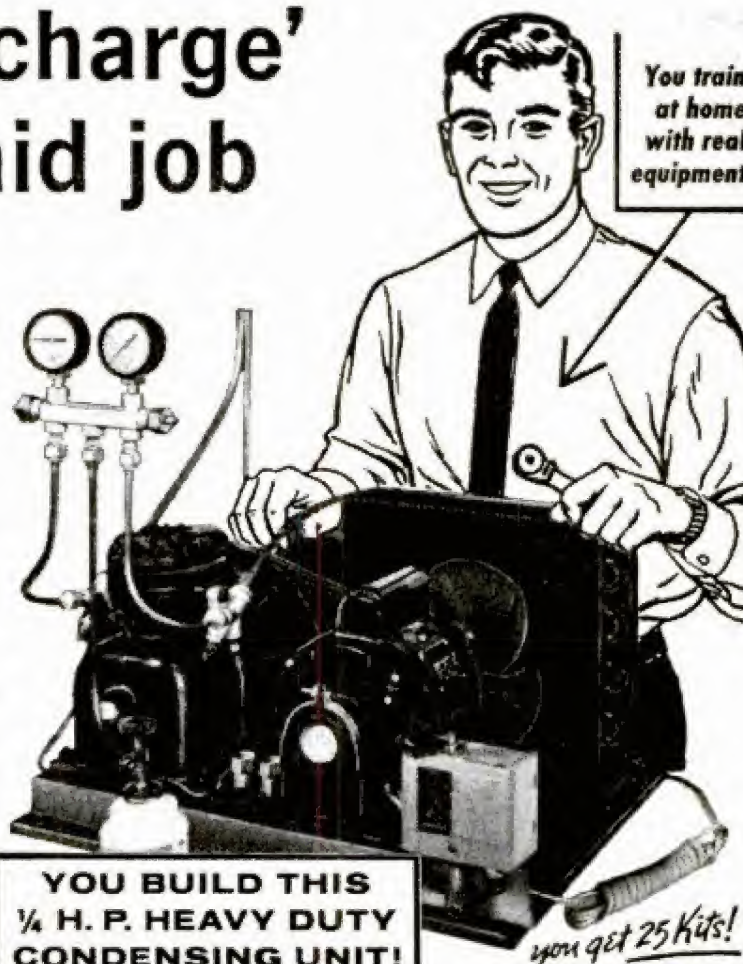
(Continued to page 14)

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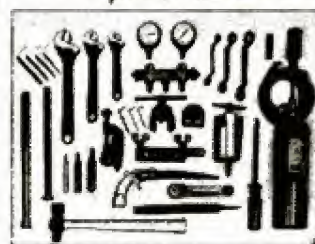


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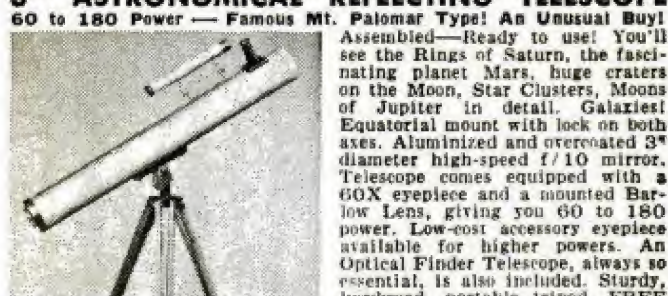
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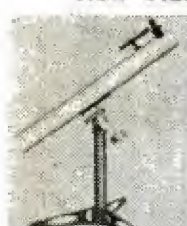
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switch prevents an amateur tampering with the various accessories or even stealing the car.

From an old sail was sewn a sturdy canvas top which is stretched over a framework, reminiscent of the Covered Wagon.

Next to the 1930 LaSalle instrument panel, which houses the speedometer, a clock, ammeter, water temperature and gasoline gauges, are three tachometers. These register the speed of the rear wheels, transmission and engine.

The Weep has an electric siren and bell, three trumpet horns, a Bermuda wicker basket, a flag holder and a compass.

The steering wheel is a real antique. A Boston piano manufacturer made it in the days when "horseless carriages" were still being steered by a rod, such as a sailboat tiller.

Its springs are from a Model-A Ford and the rear end and front axle are out of a Model-T Ford.

The windshield is from a Model-T, 1920 Ford truck and an efficient wiper is from a 1934 Hudson.

The muffler and exhaust pipe are from a 1928 four-cylinder Chevrolet—to which is attached an exhaust whistle!

A single cylinder air compressor from a 1927 Pierce-Arrow and driven by the engine, is under the 1935 Oldsmobile hood.

The Weep has 1936 Chevrolet fenders and the seats, reupholstered in red leather, came from an Essex. The radiator is graced by a Whippet ornament. The directional signals, installed before such were standard equipment, are now twenty years old.

The hand-forged snow plow is a winter attachment. The plow frame is U-shaped and was created from the front axle of a Model-T Ford.

The Weep attains a speed of thirty-five miles an hour, and boasts of fifty miles to the gallon.

Mrs. Carmela E. Toscano
Auburndale, Mass.

(Continued to page 16)



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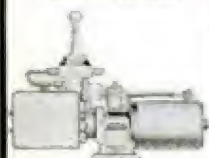
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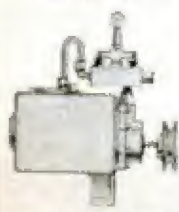
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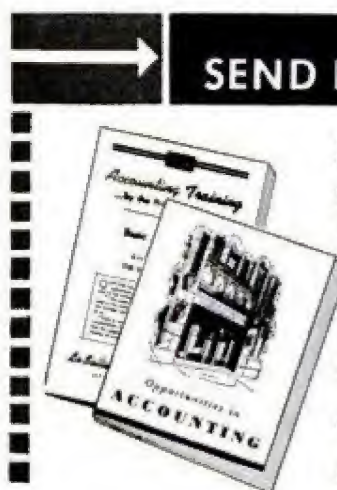
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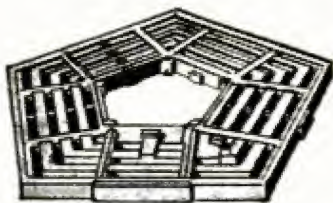
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Sidelights from the PENTAGON

By William R. Kreh

"AT FIRST IT isn't too bad, then hot ashes hit your eyes and ground glass goes to work on your throat."

A soldier was describing "CS," the Army's new riot-control gas. He and a few other GIs recently helped test it at Fort Richardson, Alaska. Wearing field clothes and protective masks, they entered the gas chamber, doffed the masks, and got a good whiff.

"At first you just blink," one of them said. "Your eyes begin to water, then burn. Then the hot ashes hit, and at the same time you feel a weird sensation in your throat, an odd metallic taste. Seconds later it turns to molten copper, then to hot ground glass."

"A riot wouldn't last long with this stuff around. It really tears you up."

The Army reports the gas is not toxic, not permanently harmful. After a few minutes in fresh air, the victims lose the worst effects, but are in no mood to riot.

Air Force scavengers have picked the bones of "Lady Be Good," the B-24 bomber lost during World War II and found 17 years later in the Libyan Desert. Their purpose was to salvage as many parts as possible to study their state of preservation. Among other things, they found hydraulic fluid still in the liquid state despite the fact that in the parched desert no rain falls for as long as nine years.

Did you know that the life-expectancy of Navy submarines is only about 13 to 15 years because of their constant exposure to salt water? Destroyers and cruisers, by comparison, last about 20 years, and carriers about 25 years.

When an Atlas ICBM showed a malfunction during recent preflight tests at Cape Canaveral, Fla., the Air Force called the hospital for emergency assistance. The problem had been

traced to a faulty elbow in the liquid oxygen line. Afraid to make repairs without a detailed diagnosis of the trouble, engineers called on S/Sgt. Donald P. Johnson, an X-ray technician. After several hours of shooting, Johnson's pictures revealed a flaw in an elbow joint. It was replaced and the Atlas hit its target.

The submarine *Pomfret* carried an unusual cargo recently. When they ran out of pennies at the Naval base at Sasebo, Japan, an urgent call was made to the Yokosuka Naval Supply Depot for more. So 50,000 one-cent pieces were loaded into the *Pomfret's* forward torpedo tube and sent to the rescue.

And if you think the Navy is having all the fun in Japan check this. At Yokota Air Force Base, the Air Force is operating a popsicle plant. Run by five Japanese employees, it turns out about 2500 popsicles a day, in six flavors, to help quench the thirst of parched airmen during hot weather.

The possibility of using seaplanes on aircraft carriers is being eyed by the Navy. The problem is how to land and take off from carrier decks. One suggestion is to cover the deck with a sheet of rubber and spray water over it as a lubricant. When landing, the seaplane can hook an arresting gear, the same as other carrier-based aircraft, and skid to a stop on its skis. When taking off, the area near the catapult can be sprayed. The water spray will still leave the deck usable for conventional wheeled planes.

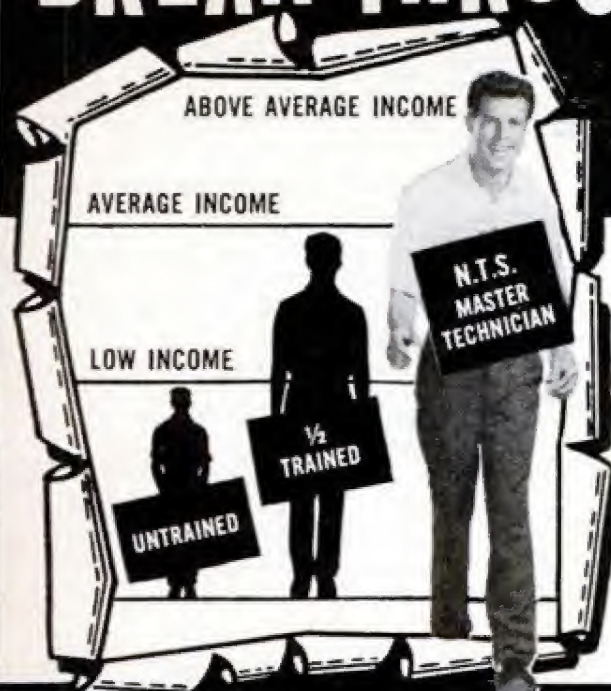
A new record was set recently when the USS *Neptune*, a Navy cable layer, anchored in 3490 fathoms—nearly four miles—of water in the Atlantic. Using a special 5000-lb. anchor, it stayed at the spot nearly four days. When it finally made ready to go, it took four hours and 10 minutes to weigh anchor. The exact location was not released, but nautical charts will show there aren't many spots in the Atlantic that deep.

Doctors at the new Naval hospital at Great Lakes, Ill., are being equipped with pocket radio receivers, each tuned to a different frequency. The idea is to be able to reach each doctor instantly, and directly, without paging him or disturbing others.

The Coast Guard is experimenting with 40-foot glass-fiber boats as replacements for conventional steel-hulled boats. Plastic neither rusts nor rots.

The Navy reclaimed silver from obsolete tableware and sold it to the U.S. Mint for a cool \$139,595. ★ ★ ★

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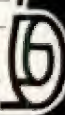
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—By James S. Thistle—

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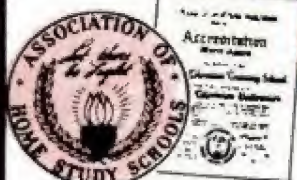
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TUNE IN ON THE INVENTORS

By John Linkletter

THE DAY MAY COME when a close call at home plate brings forth a deluge of pop bottles and catcalls aimed—not at the umpire—but at television cameras. Lloyd F. Knight of Levittown, N. Y., has come up with an "automatic baseball umpire or the like" which is really a system of television cameras that watch action on the diamond and store the images on tape. A disputed strike can be replayed over and over until everyone is satisfied it really was a strike. Knight's patent, No. 2,943,141, was assigned to Servo Corporation.

Designed as a replacement for complex and expensive proximity fuses, a "relatively simple" thermal fuse sets off a missile when heat generated by air friction reaches a certain temperature. Inventors James Meek of Silver Spring, Md., and Raymond Warren of McLean, Va., assigned their patent, No. 2,937,596, to the Army.

Air travelers will benefit from two new patents. One, the idea of Robert Bell of Palm Beach, Fla., is a glass-bottomed sight-seeing lounge for airplanes. Passengers would sit around the floor window to view scenes that can be seen in their entirety only from the air. Another air scheme comes from Paul Dostie of Quebec, Canada, who devised an accordion-pleated tube which connects the tail of one plane to the nose of another. Passengers could walk the tube while the planes are in flight. Bell has patent No. 2,942,811, and Dostie has No. 2,942,816.

A simple key ring that holds keys in place so that they can be removed only by someone who knows the secret of the device won patent No. 2,938,375 for Frederick Wehrli of the Bronx, N. Y. The ring also functions as a simple lock.

An underwater marine scaffold—a horizontally and vertically telescoping unit—fits all types and sizes of vessels for repairs at sea or in harbor. It may also be lowered to great depths for salvage or deep-sea operations. The inventor, Capt. Semon Kronhaus of Los Angeles, Calif., was awarded patent No. 2,919,763. ★ ★ ★

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Keeping up with the ATOM

By James Biery

A PILOT PLANT for removing radioactive strontium from commercial quantities of milk has been established in St. Louis, Mo., which leads other areas in the U.S. in having such contamination. Strontium 90 is produced by nuclear explosions, and its radioactivity, thought by some scientists to cause leukemia and bone cancer, lasts for years. Dr. H. T. Blumenthal, one of the scientists engaged in the project at the Pevely Dairy Company milk-processing plant, found a resin of the sulfonic acid type capable of taking up to 93 percent of the strontium from milk samples while making no appreciable change in the mineral balance of the milk or the taste.

Argonne National Laboratory, in Illinois, is building a \$29,000,000 atom smasher that is expected to produce large quantities of subnuclear particles that previously have been available to high-energy physicists only in small amounts. One such particle is the neutrino, which has no electrical charge and can be detected only by making it react with another particle. The particle was detected in 1956 and it is so elusive it can pass through the Earth and the entire solar system without being deflected. Argonne's atom smasher will be the first to make enough neutrinos to allow experiments with these bits of matter.

A \$12,000,000 electron accelerator will go into operation at Cambridge, Mass., next year to provide scientists at Harvard and the Massachusetts Institute of Technology with the smallest known particles of matter for study. Located in a circular subway 236 feet in diameter, the accelerator is expected to spurt out—60 times a second—a pulse of 100 billion electrons moving at 99.9999996 percent of the speed of light. Four dozen magnets, each 12 feet long and weighing eight tons, will hold the electrons in place while they are being accelerated through an oval tube. Energy will be imparted to the electrons by a radio-frequency system comparable to that of the largest search radar systems. They will dissect stable particles to produce unstable particles such as negative protons. ★ ★ ★

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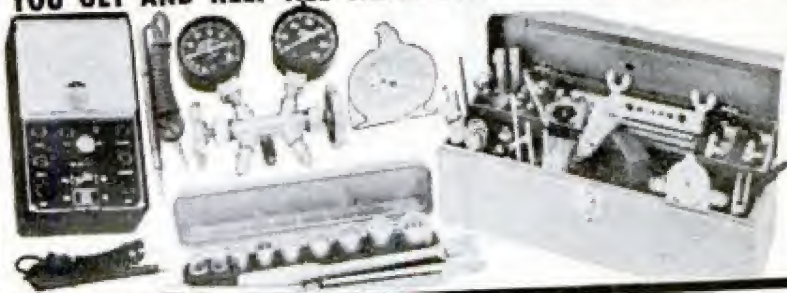
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Fig. 1. Adjusting breaker and contact points in distributor.

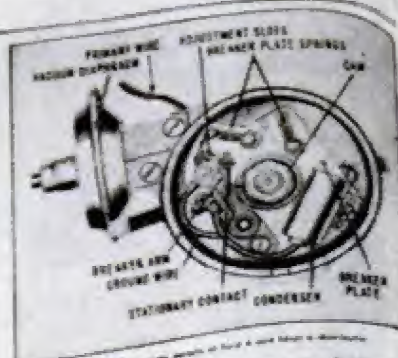


Fig. 2. Breaker plate points at top of distributor.

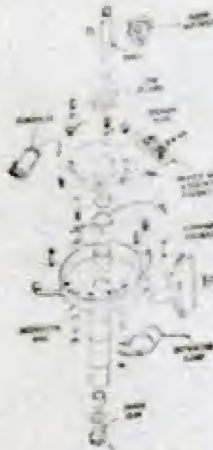


Fig. 3. Exploded view of distributor showing the breaker plate, contact points, and condenser.

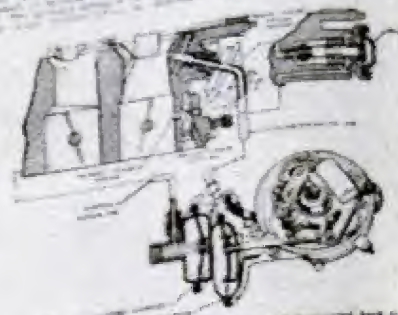


Fig. 4. Exploded view of distributor showing the breaker plate, contact points, and condenser.

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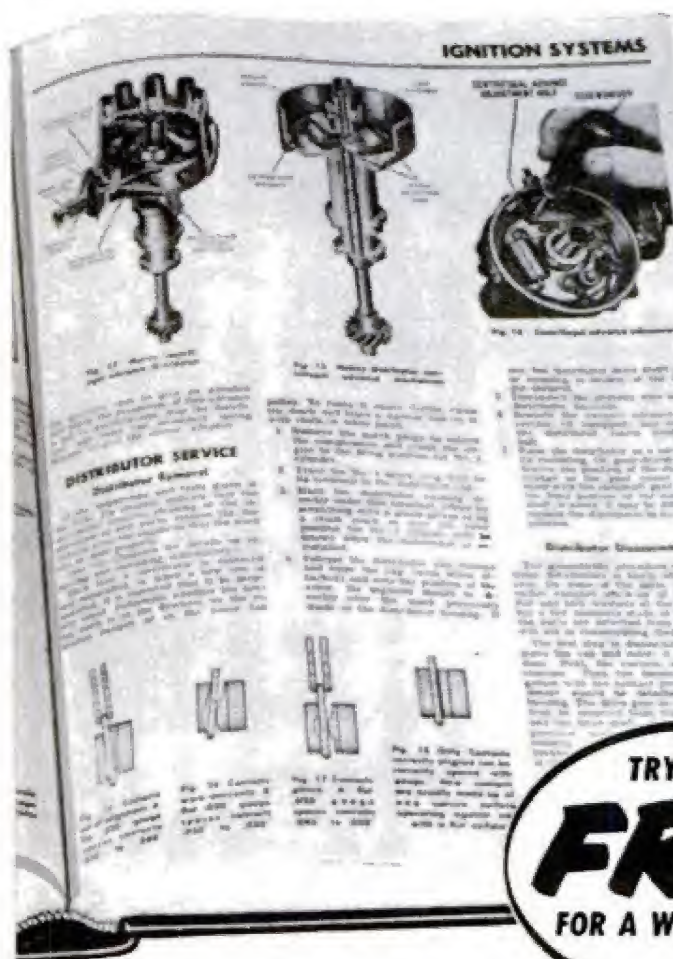
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"The engineers dreaming about the supersonic transport aircraft are more or less in agreement that it would be necessary to go to at least Mach 2.5 (two and a half times the speed of sound), and probably to Mach 3, to produce a machine that would make sense economically. These speeds can only be achieved at altitudes of 50,000 to 60,000 feet. Altitudes as high as 70,000 feet are being discussed. At such heights, a sudden loss of pressure in the passenger cabin would result in disaster for all persons aboard even though they wore oxygen masks and were breathing pure oxygen. Sudden depressurization would cause almost immediate unconsciousness, followed by loss of life itself. The only protection against this, the individual pressure suits which military fliers use for high-altitude work, is obviously impracticable for commercial airline operation.

"Another unfavorable environment problem is the high temperatures encountered cruising at high Mach numbers. At Mach 3, the skin temperature on an aircraft would be in the area of 570 degrees F., which in turn requires a reliable refrigeration system to protect passengers from this intense heat and maintain a comfortable cabin temperature.

"There are numerous other difficult problems involved in supersonic flight. For example, these airplanes will be extremely noisy on takeoff and will have to be held well below supersonic speed during climb to prevent a series of disturbing and even destructive sonic booms along the path of flight. Even at high altitude, sonic booms are disturbing to people on the ground, although possibly tolerable when the planes are flying at altitudes above 50,000 feet.

"Admittedly, the view that there will be no supersonic airliner within the next decade is conservative. However, it is based on known engineering principles of 1960, presented in the light of realistic airline operating experience. What I have said should in no way be interpreted to mean supersonic airliners are an engineer's unrealistic dream. They will be built and flown but will not be seen in scheduled operation for at least 10 or 12 years."

—J. A. HERLIHY,
Senior Vice-President,
United Air Lines

□ In flight tests, the U.S. Navy's twin-turbine, submarine-hunting helicopter, the HSS-2, hovered continuously over one spot for more than three hours—a far more demanding feat than normal forward flight.

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ITEMS FROM ALL OUTDOORS

By Dick Kirkpatrick

NEXT TIME you meet someone who thinks he's got an easy job, tell him to go see William Schmidt, of Annapolis, Md., a retired boilermaker who has been hired by the Magothy River Association to fish (yes, fish) four hours a day, five days a week. At \$1.70 an hour, whether he catches anything or not. The Association and a local sports group, working with the Maryland Department of Research and Education, is testing the theory that fishing is better around oyster bars. Schmidt fishes half his time around an area where 700 bushels of shells have been dumped; the other half in other areas. He keeps a record of his catch and reports on the success of other fishermen in the area. But other than that, all he has to do is fish. How's that?

Lt. Charles Meyer, of New York City's river-front squad, has offered this check list to help cut down thefts and vandalism around boats:

1. Store detachable equipment in lockers.
2. Don't leave valuable property in an unattended boat.
3. Keep unauthorized persons away from docks; note descriptions of loiterers.
4. Note descriptions of strangers trying to sell equipment; it may be stolen.
5. Put a secret mark on your property for later identification if it's stolen.
6. Record serial numbers of property.
7. Secure motors with lock and chain.
8. Report vandalism or theft to police.
9. In clubs, appoint a security officer.
10. Get to know your waterfront police.

Remember the unusual sailing "Kolumaran" that graced the cover of this year's March Boating Issue? The designer, Dean Kennedy of San Diego, Calif., reports that inquiries from readers of PM and our seven international editions are still coming in at the rate of about two a day, and that the response from overseas has been remarkable. He reports letters from England, France and South Africa (3 each); Denmark, West Germany, Australia, New Zealand and the Philippines (2 each); and singles from Argentina, Mexico, Honduras, Ecuador and Okinawa. ★ ★ ★

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WHAT'S UP IN THE AIR



By Kevin V. Brown

SPACE STATIONS may have trouble attracting tenants, and for an ironic reason. After the initial excitement of pioneering space travel wears off, the spaceman, an extraordinary sort of individual, may succumb to a rather ordinary human failing—boredom. Recent Air Force tests, in which two crews spent 15 days in earth-bound "space cabins," brought this into sharp focus. The airmen's chief reactions: "We were bored, tired and sleepy." They had trouble getting to sleep, trouble getting awake and, "after our work was done, there just wasn't anything to do." North American Aviation Co. is working on the problem of providing a more interesting environment in cramped quarters for men on space duty, fearing that, if it isn't solved, recruits may be as hard to get as lighthouse keepers. Ping-pong and television perhaps?

An airplane ticket for three cents? It happened in Spain, land of the bullfight, where tradition and protocol are paramount. An agent for Iberia, Spain's national airline, checking a cargo of 100 chickens for transport from Barcelona to Tortosa, felt it his duty to issue a ticket for each chick. Price: 1½ pesetas each (three cents).

Photography is receiving increasingly ingenious attention in space research. The Navy plans a reconnaissance satellite that will be aimed to pass over a preselected point on earth, take pictures, and then be recovered after one orbit. RCA is working on an electric camera for satellites that will do what no space camera has done before—take pictures of the satellite itself. Flashed back to earth, the photos would give visual reports on the satellite's performance.

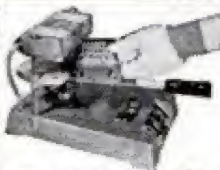
In the wake of the summit fiasco at Paris comes a report that the U-2 was not the only American airplane that upset Nikita Khrushchev. After one night at the suburban home of the Russian ambassador, Nikita moved back to the USSR Embassy in town. The noise of the American jetliners, taking off and landing from nearby Orly Airport, had kept him awake most of the night. ★ ★ ★

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BULLETINS *from the world of* SCIENCE

By James Biery

THE FLIGHT of an unusual man-made satellite, shock waves and sound waves are providing proofs that our wrinkled old Earth not only is pear-shaped, it's sometimes shaped like a football. And, once-upon-a-time, it may even have been squeezed oddly out of shape by a heavy-fingered glacier.

When the U.S. fired two satellites into orbit from a single rocket this summer, the instrumented spheres were kicked apart by a spring arrangement. One, a 42-pound ball sent to measure types of solar radiation, made the 500-mile trip piggyback atop the 233-pound Transit II-A, which will provide a navigation check-point for ships, planes and submarines. Its orbit will be studied to confirm the U.S. Navy's conclusion (reached by observing effects of gravity on satellite orbits) that Earth is slightly pear-shaped.

Earth appears to have quivered like a plucked guitar string during four or five days of this summer's Chilean earthquakes. As a result, it frequently, but slightly, assumed the shape of a football. "Free vibrations" caused by the quakes resulted when long shock waves passed around the Earth and came back to the same spot, after shorter waves had died out. When the distance from wave crest to wave crest is half the Earth's circumference, the wave has a "football mode," and power to distort Earth's shape. Such vibrations pass an observatory about once an hour. At least one vibration produced by the Chilean quakes passed every 25 minutes. These vibrations were observed by Dr. Jack Oliver, a seismologist at Lamont Geological Observatory, Palisades, N.Y., one of the first men to observe such an occurrence.

Ice soundings made by U.S. and U.S.S.R. tractor parties in Antarctica, coupled with gravity readings, suggest the continent is in isostatic equilibrium—its rocky surface has subsided to compensate for the heavy load of ice it bears. If the ice melts, mountains would gradually rise about 2500 feet, according to the Soviets' postulate. They say the main body of Antarctica was one of the highest continents in days when it was green with forests but its height and polar location encouraged growth of glaciers that bore down with such weight the continent sank. ★★ ★

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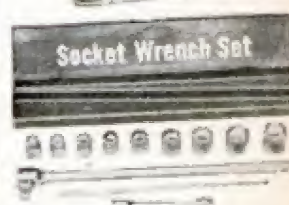
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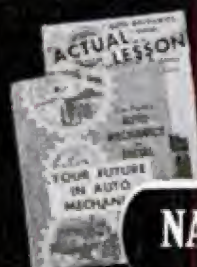
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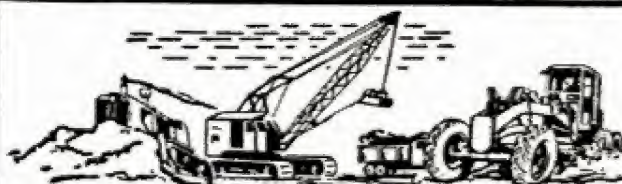
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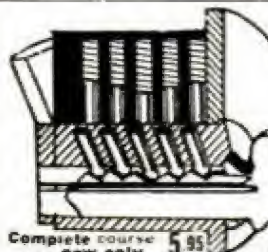
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Fish should not be able to swim so fast, according to all the natural laws governing velocity for energy output, and the Naval Ordnance Testing Station at China Lake, Calif., has assigned a team of scientists from the University of Washington to find out the reason. By studying live fish swimming in a controlled current, the scientists confirmed that they swim further and faster on a given amount of energy than a wooden model of the same fish can be moved with the same amount of force. Motion pictures are being made of the test fish in the clear plastic current flume to study their motion and the flow of water around their bodies. The water turbulence behind the fish may, it is believed, hold clues to their efficiency. The information will be of value in designing both surface and underwater craft.

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BIG Money raising fishworms and crickets. Free literature. Carter Hatchery, Plains, Georgia.

READ "Progressive Mailtrade," the magazine that tells how to make money by mail. Quarter brings sample and special offer. Progressive Mailtrade, Box 357, Sheboygan, Wisconsin.

WANTED Men, women bait raisers. Guaranteed market. Down-East, PM-5, Box 149, Bangor, Maine.

START A profitable subscription business in spare time! We need men and women (young and old) as representatives for all leading national magazines. Liberal commissions on all subscriptions. Supplies free. No experience needed. Send this ad with your name and address to: Popular Mechanics, Room 9-O, 250 W. 55th St., New York 10, N. Y.

BUILD Backyard greenhouses. Cost low as \$29.95. Sell for \$59.50 up. Plans \$1.00. Refunded first material order. Every homeowner a prospect. The Jefferson Co., Box 416, Jefferson, Oklahoma.

BIG Profits possible in library research! Easy! Pleasant! Full-sparetime! Write: Trotta (PMJ), 2036-66th, Brooklyn 4, New York.

TERRIFIC Profits. Easy. Assemble and sell waitress name plates, all businesses. Sample parts, instructions, \$1.00. Ace Novelty, Box 182P, Maywood, Calif.

MAKE Big money with fast-selling line self-help manuscripts, many titles! Imprints available; drop shipments if desired! Complete details to established mailorder dealers only! Economy, Box 2586-PM, Greensboro, North Carolina.

MONEYMAKING Home-business. No selling. Typewriter helpful. Refundable samples 50c. Interstate, 37 Besch, Albany 9, N. Y.

TEN Patio-garden accessories, easily built, no equipment, local materials. Business, hobby. Plans \$2.00. Hetrick, 11290 Wilson Road, Riviera Beach, Florida.

12 SURE-FIRE Mail order business plans plus 30 fast-selling products to manufacture in your basement. Complete \$1.00. Lekoa Enterprises, 2968B Wilson, Campbell, Ohio.

MAILORDER Below wholesale sources 750,000 items. Free lists. Dean's, Box 40-PM, Elberton, Georgia.

10,000 DOLLAR-Making formulas! Arkin, 1448 Crotona Park East, New York 60.

SELL Cars! Self training manual by expert. Approved by 7 auto editors. Free details. Dept. PMX, Westminster Automotive Sales Consultants, Box 130, Scarborough, Ontario, Canada.

BIG Profit selling Ferto (manure) pots and other house plant fertilizers. Novel, different. No competition. Send 25c for instructions and samples. Fertopot, Pitts-town, N. J.

MAKE Beautiful concrete products for profit. Useful lawn and home items. Small investment in our fiberglass forms puts you in business. Zeidler, Clear Lake, Iowa.

EXPORT — IMPORT

JAPAN: Direct mail-order, 26 page catalogue, kimonos, dolls, novelties, gifts, business information, manufacturers' names, addresses. Send \$1.00. Clarence Yamagata, 814 Toginbiru, Marunouchi, Tokyo.

IMPORTED Expressive Israel character dolls, \$3.98. The Azure Co., Spencer, W. Va.

IMPORT And gift catalog free. Sharon, Box 5114, Kansas City 32, Missouri.

SCIENCE & CHEMISTRY

CHEMICALS. Apparatus, glassware. Illustrated catalog 25c. Bio Chemical Products, Somerset, Belmont 78, Massachusetts.

CHEMICALS And apparatus for industrial, analytical, and private laboratories. Catalog 25c. Dept. M-50, Biological Supply Co., 1176 Mt. Hope Ave., Rochester 26, N. Y.

ILLUSTRATED Catalog: Chemistry, mineralogy, biology 25c. Tracey Laboratories, Evanston, Illinois.

ROCKET Supplies for amateur rocketry. Catalog 25c. Mervin Hill Company, R.D. #1, Seward, Penna.

POPULAR Mechanics book, "Science Year," illustrated survey of last year's developments in science. Covers rockets, medicine, astronomy, electronics, etc. Send \$1 to Service Bureau, Room 517E, Popular Mechanics, 200 E. Ontario, Chicago 11, Illinois.

UNUSUAL Chemistry books, courses, kits! Rare chemicals, cheap! Catalog 25c. NSC, Box 11133, Palo Alto, Calif.

EXPERIMENTERS: New! Bigger catalog and "Experiments Booklet," Only 25c. Hagenow Laboratories, Manitowoc, Wis.

AMAZING New book of science experiments, formulas, and catalogue of laboratory supplies. Only 35c. National Scientific Co., 13 S. Park Avenue, Dept. PM-9, Lombard, Illinois.

ROCKETEERS: Illustrated catalog, plans, formulas, 25c. Central Rocket Company, Waupaca, Wis.

BOOKLET. "Scientific Oddities," 10c. Franks, 3121 South Racine Avenue, Chicago 6.

CHEMISTRY Catalog 25c. Textbook bargains! Laboratory Sales, Box 161A, Brighton, Mass.

ILLUSTRATED Catalog 25c. Chemicals, glassware, biologicals. Winn Chemicals, 1744 West 23 Street, New York 11, New York.

ROCKET Chemicals, apparatus. Keefe Scientific, 159-10A Hillside Avenue, Jamaica, New York.

FORMULAS. PLANS, ETC.

MAKE Waterproof cement paint 5c lb.! Details free. Courtney, Ancaster, Ontario.

FORMULAS—All kinds. Latest. Best. Literature, stamp. Kemixal, Park Ridge, Ill.

FORMULAS For latest money-making discoveries. New! Good! Valuable literature free! Miller, Chemist, 1517-D, Tampa, Florida.

RESILVER Mirrors—make one-way mirrors. Both \$1.00. Kem-Mir, Park Ridge, Illinois.

LATE. Modern manufacturing formulas. List free. Moon Chemical, Martville, New York.

PLASTICS

PLASTIC And supplies for laminating Colomac, 12 Center, New Haven, Conn.

BOXES, Plastic, 200 sizes. Free list. Althor, 170 Bay 23 Street, Brooklyn, N. Y.

NEW Liquid casting plastic, clear, colors. Embed real flowers, butterflies, photos, coins. Send 25¢ for two handbooks "How to Cast Liquid Plastics" and "How to Make Extra Money at Home." Castolite, Dept. K-101, Woodstock, Illinois.

VINYLITE, Plastic, laminating supplies, machines. Solomson, 4 Beacham, Everett 49, Mass.

MAKE Sell signs. Plastic letters. Samples 25¢ refundable. Dixie Plastics, Lakeland, Fla.

AGENTS WANTED

PRINTING, Advertising salesmen—Excellent moneymaking sideline selling decalcomania name plates, small quantities Automobile initials, sign letters. Free samples. Ralco, XL, Boston 19, Mass.

SELL Champion, AC, Autolite spark plugs. Reconditioned, electroplated, guaranteed 10,000 miles. 100% profit. Free sample. Lee Plugs, 1608-E Roberts, Houston 3, Texas.

YOUR Own business—Used suits \$1.50; overcoats 85¢; mackinaws 35¢; shoes 12½¢; ladies' coats 30¢; dresses 15¢. Enormous profits. Catalog free. National Mail Order, 211-AA Roosevelt Road, Chicago 8, Ill.

DOUBLE Spare-time earnings with 65¢ profit on exclusive, new \$1.25 Christmas card assortment. Imprints, 40 for \$1.50. Over 400 assortments, gifts retail \$1 up. Get samples on approval, \$1.25 assortment. \$1 gift on free offers. Cardinal, 1400 State, Dept. 36-A, Cincinnati 14.

SELL Famous Swami car and furniture polishing cloths, treated with General Electric Silicone Oil. Over one million sold. Write Swami Kloth, Box 155, Great Neck, N. Y.

BIG Profits. Stamp social security plates, key protectors. Sample 50¢. Catalog free. General Products, 11 No. Pearl St., Albany 7, N. Y.

START Making money now. Earn top commissions taking orders for all magazine subscriptions. Friends and neighbors are your prospects. No experience needed. Write for free money-making kit. McGregor Magazine Agency, Dept. 5A, Mount Morris, Illinois.

MAKE Up to \$50.00 a day soliciting delinquent accounts. Terrific commissions. Write today. National Credit, 304Y Pickwick Bldg., Kansas City 6, Mo.

RUN A spare-time greeting card and gift shop at home. Show friends samples of our new 1960 Christmas and all-occasion greeting cards and gifts. Take their orders and earn to 100% profit. No experience necessary. Costs nothing to try. Write today for samples on approval. Regal Greetings, Dept. 79, Ferndale, Mich.

FARM 200 Acres or less? You can make \$20 or more daily spare time. Supply customers McNess farm-home necessities. Write McNess, Freeport 24H, Ill.

MAKE \$10-\$100 A day! Sell new 5 year light bulbs. Guaranteed. Send for sample 6 pak \$1.98. Sells for \$4.69. Free details. Sunmaster, 366 Fifth Ave., Dept. 09PMC, New York City.

BUSINESS Kit free! Postcard puts you in business! Complete line 230 shoe styles, jackets! New discoveries pay big commissions. No investment. Send for free kit. Mason, Chippewa Falls KA-324, Wisconsin.

MAKE \$25-\$500. Sell Christmas, all occasion greeting card assortments; gifts, wrappings, stationery. Experience unnecessary. Big profits. Name imprinted Christmas cards. Salable samples on approval. Write Hedenkamp, 361 Broadway, Dept. PM-64, New York.

NEW Bathroom deodorizer. Hangs on wall. Banishes odors bathroom, kitchen. Lightning seller. Samples sent on trial. Kristee 73, Akron, Ohio.

CHRISTMAS Cards—with customer's name imprinted. Personal and business designs—all in one album. These deluxe cards pay deluxe commissions. Earn \$300 to \$500 (plus bonuses) easily this season, even in spare time. Sales experience unnecessary. Free sales kit includes sample album and easy-to-follow selling instructions. Send for kit now; pocket profits next week! Write: Process Corp. (reliable for 39 years), Dept. PM-3, 1954 S. Troy, Chicago 23, Ill.

MEN-Women sell penny shoe shine and famous nationally advertised Turtle Wax products. Earn big money fast! Penny shine pre-sold by Bing Crosby coast to coast. Other big promotions. 122% profit possible. Send for free information. Plastone Sales, Dept. 60E, 1800 N. Clybourn Ave., Chicago 14, Ill.

UP To \$300 extra money. Show friends fabulous self-selling Evans Christmas card, gift line. Profits to 100%. Send no money—write for sample boxes to be paid for or returned, plus big free album personalized cards, 2 catalogs 300 items. New England Art Publishers, North Abington 940-C, Mass.

MAKE Money selling ties. Free catalog. Write to Philip's Neckwear, 24 West 22nd, New York City.

FREE! Beautiful Mexican curios! Rush 30¢ stamps mailing. Sylviak, Apartado 9036, Mexico City.

DAMASCENE Earrings Exotic orientalism. Huge profit. OHGA, PM-204, Sigakenkusatu, Japan.

MAKE Profitable men's-women's wear. Sample free. Sunmade, Brockton 64, Massachusetts.

TREMENDOUS Margin! Religious Medallion line starts buying rush. Multiple profit plan. Sell stores, individuals. Details free. Romaine Products, Dept. PM36, Oaklyn 6, New Jersey.

MEN! Women! 60% profit on cosmetics. Famous nationally advertised Hollywood cosmetics pay 60%. Make \$25 day up. Hire others. For free samples, details, write Studio Girl, Glendale, California, Dept. 1209J.

FUNNY Cards—50 samples 25¢. New wholesale gag, novelty catalog free. Dohn-MM-Marks, Broadview, Illinois.

SPARE Time can mean extra cash for you. With no experience, no big investment, you can earn fantastic profits! Take orders with big, colorfully illustrated catalog of toys, jewelry, gifts, collector's items, household gadgets. Work your own hours. Write for free catalog. North Star, Dept. 6-605, 251 East Fifth Street, St. Paul 1, Minnesota.

MAKE Money 50% faster! Keep 75¢, not 50¢, on \$1.25 Christmas card assortment; \$75.00 on hundred. 199 exciting assortments, gifts, \$1 up. Free samples 53 personalized cards. Gift bonuses. Approval samples. Free gift offer. Creative, 4401 Cermak, Dept. 506-P, Chicago 23.

PHOTO Murals. Large full color. Every bare wall prospect. Free color brochure. Details. Sanders, Dept. PM-9, 1359½ Poplar, San Bernardino, Calif.

MAKE \$1,000 Extra this year! Over 800 best-selling items. Gifts for men, women, children, the home Distinctive greeting cards, stationery, jewelry, cosmetics, mechanical gadgets, novelties, household helps, toys, games. No minimum order. Samples on approval. Make up to 92% profit! Write for free catalog. Greetings Unlimited, 6-207 Park Square, St. Paul 1, Minn.

CAPITALIZE On bowling's popularity. Sell "My Bowling Scores"; new, different. Bowlers go for it. Over 100% profit. Sample copy 25¢. Deductible when you order. Pope Enterprises, 1907 Cuyler Avenue, Chicago 13, Illinois.

BIG Profit. Stock market game. Buy, sell, collect dividends. Fascinating family fun. Game, details \$3.00 postpaid. Satisfaction guaranteed. Schmid Game Co., 767 Van Buren, St. Paul 4, Minn.

MAKE Profitable men's-women's wear. Sample free. Sunmade, Brockton 64, Mass.

\$300.00 WEEKLY! Part time. Chemical supercharger. Increases RPM, upgrades gasoline, eliminates knocks and pings. Guaranteed. Dept. PM, Box 530, Freeport 30, New York.

BE The Popular Mechanics representative in your neighborhood and earn big profits in your spare time. Write Popular Mechanics, Room 9-A, 250 West 55th St., New York 19, N. Y.

BIG Profits! Terrific repeats, selling new packaged chamois skins. Wholesale, retail, direct. Salable sample \$1.00 postpaid. Details free. Samuel Glenn-MP90, Box 507, Jacksonville, North Carolina.

SELL Amazing glow-in-dark pictures. Big profits. Samples free. Madison Mills, 303 Fourth Ave., New York 10, N. Y.

60,000,000 PROSPECTS. Amazing new product. P.O. Box 42-608, Miami 42, Florida.

SPARETIME Profit. New household item. Every housewife a customer. 10¢ information. B. Schuelter, 1600 Decarie, St. Laurent, Quebec, Canada.

NEW Sleeping comfort means generous profits with Electro-Warmth. Beats electric blankets 10 ways, costs less. Adds no top covering you sleep on it. Best season starting. Patented Products Corp., Dept. PM-960, Danville, Ohio.

COSMETIC Representatives. Need all 50 states your city town. Latest cosmetics sensation sweeping nation. Hire others. Earn fabulous commissions. Write Nu-Living, Inc., 7485 Wallings Road, North Royalton 33, Ohio.

TOILET Soap and shampoo in tubes. Imported. Details. Johnson's Supply Company, New Rochelle, N. Y.

SHOES—Men's, women's, children's. Low as \$1.10. Free brochures. Jules, 273-A West 40th Street, New York City.

MEN. Women. Make money spare time and earn new car as bonus for encouragement. Amazing hosiery guaranteed to wear without holes, snags, and runs, or replaced free. For example, lovely 60 gauge nylons guaranteed for as long as 1½ years, or replaced free. Write: Wilknit, 1709 Washington, Greenfield, Ohio.

YOUR Ad in this space will get some good agents for you. Yes, I'll prove it. Write for Folder "A" right now. F. W. Johnson, Classified Advertising Manager, Popular Mechanics Magazine, 200 E. Ontario St., Chicago 11, Ill.

BUY IT WHOLESALE

HANDMADE Western boots. Big free catalog. Ysleta Boots, Box 815M, Ysleta Station, El Paso, Texas.

NEW Deluxe wholesale catalog, automobile catalog, and others. Housewares, appliances, refrigerators, freezers, washers, dryers, television, radios, furniture, clothing, luggage, binoculars, phonographs, recorders, cameras, projectors, typewriters, power tools, toys, sporting goods, watches, jewelry. Name brands. Huge discounts. Postcard (any card): Selbyco, Decatur 160, Illinois.

JOIN Now and save 20% to 50% on nationally advertised appliances, furniture, carpeting, photo equipment and other famous brand merchandise. Limited exclusive membership. Write for free brochure to Mutual Buyers Club, Inc., Dept. PM-1, 1000 W. Roosevelt Road, Chicago 8, Ill.

WORLD'S Largest wholesale supply. Buy from 679 American, European, Japanese wholesalers. Tailormade suits from Hongkong. 123 dropship catalogs. Rockbottom prices. Free details. International Buyers, 216-M Jackson, Chicago 6, Illinois.

VITAMINS: High potency. 1½¢ daily. Free details. Barclay Supplements, North Scituate, R. I.

TYPEWRITERS, Cameras, watches. New, latest. All makes. Simms, Warwick, N. Y.

WHOLESALE Catalog. You profit. Free details. Loeber, 224-D Wyatt, Lincoln, Ill.

2,000 PAGES Wholesale catalogs! Write: Mosser, Box 47-B, Newark, Ohio.

BUY At factory prices. Typewriters, housewares, jewelry, watches, musical instruments, appliances, hardware, television, sporting goods, cameras. Thousands other nationally advertised products. New factory buying plan saves you up to 40% below wholesale. Details free. Factory Supply Company, Box 1857B, Paterson, New Jersey.

PHOTOGRAPHIC Equipment. Free wholesale catalog. RNG Sales, PM, Wildomar, California.

BULOVA. Benrus watches like new \$5.95 up. Illustrated catalog with hundreds of bargains, free. Cosmos, New York 35, N. Y. Dept. 615.

ELECTRIC Guitars, amplifiers, wholesale. Free catalog. Carvin, PMW, Covina, Calif.

WHOLESALE: 850,000 Items. Supply source directory 25c. Idealer, Park Ridge, Illinois.

LARGEST Wholesale supply source in U.S.! Furniture, clothing, appliances, housewares, automobiles and accessories, tools, sporting goods, hobby supplies, farm equipment, imports, new products, bargain merchandise. Free details. Associated Wholesalers, Box 2068-DD, Sioux City 4, Iowa.

USED And new watches \$2 up. Free list. Southern Watches, 5-PM So. Wabash, Chicago 3.

BELOW Wholesale most merchandise. Write: Factory Buyer, 446, Jacksonville, Illinois.

BUY Wholesale! Big catalog! Postcard: Spartan Industries, 1236-F Winona, Chicago 40.

SALESMEN—DISTRIBUTORS

PROFITABLE Lifetime oil business. Franchises still available for automotive Molybdenum. Small investment. Pacific Lubricants, 5807-PM9 Beverly, Los Angeles 22, Calif.

MAKE Extra money—Big cash commissions plus premiums for you and your customers. Sell advertising book matches. Sensational new tenor, glamour girls, hillbillies; dozens others. All sizes. Quick daily sales; big repeat business. Free master kit makes selling easy. No experience necessary. Superior Match, Dept. M960, 7530 Greenwood, Chicago 19.

ANYONE Can sell famous Hoover uniforms for beauty shops, waitresses, nurses, doctors, others. Miracle fabrics—nylon, dacron, wash 'n wear cottons. Exclusive styles, top quality. Big income, real future. Equipment free. Hoover, Dept. L-100, New York 11, N. Y.

CALENDARS. Advertising novelties, matches. All styles, including religious, varnished, 12 sheet, girls. Hundreds of advertising novelties, book matches, etc. Fleming Calendar Co., Sales Division, 6539 Cottage Grove, Chicago 37, Ill.

MONEY-Making opportunity! Take big profit orders for world famous patented varieties fruit trees. Also flowering shrubs, roses, vines. Big sales outfit free. Stark Bro's, Desk 30191, Louisiana, Missouri.

BUSINESS Kit free! Postcard puts you in business! Complete line 230 shoe styles, jackets! New discoveries pay big commissions. No investment. Send for free kit. Mason, Chippewa Falls KS-324, Wisconsin.

SHINE Shoes without polish. New invention. Lightning seller. Shoes gleam like mirror. Samples sent on trial. Kristee, 42, Akron, Ohio.

MAKE Extra money selling advertising matchbooks. Free catalog and sales outfit. Matchcorp, Dept. PM-90, Chicago 32.

\$1,000.00 A Month for making dramatic 3-second demonstration of amazing lightweight Presto Fire Extinguisher. New chemical used by airforce snuffs out fires instantly. Only \$4.95. Terrific commissions. Millions want it. Free kit. Merlite, 114 E. 32nd, Dept. P-66T, New York 16.

WILL You wear new suits and topcoats without one penny cost and agree to show them to friends? You can make up to \$30.00 in a day even in spare time, without canvassing. J. C. Field & Son, Inc., Dept. K-1826, Harrison & Throop Sts., Chicago 7, Ill.

LAFF Lighters. America's hottest selling new novelty. Make \$25.00 to \$60.00 daily, easy, fast. Details free. Send \$1.00 for "sell on sight" sample demonstrator. Clever creations, Dept. P, Terminal Sales Building, Seattle 1, Washington.

YOUR Own spare time home-operated business. Take over your area as our service distributor keeping retail stores supplied. Nationally advertised 30-year-old line pays up to \$20.00 hour. Under \$100.00 for merchandise gets you started. For samples, highly successful plan, write Novo, 3855 Lincoln, Desk W-85, Chicago 13.

GET New shirt outfit free! \$90 weekly on 5 average orders a day. Famous quality made-to-measure dress and sport shirts at \$3.95 up, sell fast to all men. No experience needed. Full or part time. Write: Packard Shirt Co., Dept. 222, Terre Haute, Ind.

FULL. Part time. Babies' patented jumper-exerciser. Booming market. Nationally known. Big profits. Free testimonials, literature. Shurtliff Manufacturing, 225 Southeast Tenth, Pocatello, Idaho.

MAKE Up to \$50.00 a day soliciting delinquent accounts. Terrific commissions. Write today. General Finance, 304V Pickwick Bldg., Kansas City 6, Mo.

IF You're interested in making money in selling, see the hundreds of exceptional opportunities in Salesmen's Opportunity Magazine. Send name for your copy, absolutely free. Tell us what you're selling now. Opportunity, 848 N. Dearborn, Dept. 17, Chicago 10, Illinois.

MONEYMAKING Opportunity in fast growing market selling attractive outdoor advertising pennants. Write: Radder Products, Box 31, Colvin Station, Syracuse 5, New York.

YOU'LL Make big money selling famous Swami polishing cloths, treated with General Electric Silicone oil. Over one million sold. Write Swami Kloth, Box 155, Great Neck, N. Y.

SELL Dickey's complete line of auto cleaners. 10 products. Established 30 years. Dickey-Becker Mfg. Co., 2624 North Adams, Peoria, Ill.

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CHALLENGING Jobs are available in Southern California. Current directory of missile and electronic engineering companies employing engineers, draftsmen, technicians, etc. \$1.00. Dick's Service, Box 413, Montebello, California.

U.S.A. Foreign jobs, up to \$1600.00 monthly. Construction, clerical, supervisory, etc. Skilled, unskilled. Free transportation. Unusual opportunities. Complete information plus worldwide project listings. Only \$2.00 (\$2.25 airmail). Satisfaction guaranteed. International Reports, Dept. M, 109 W. 42, New York 36, N. Y., or Box 621, San Jose 6, Calif.

CHICAGO! Jobs galore! All types; high wages. Men, women. Big Sunday classifieds. Terrific business opportunities included free! \$1.00. Airmail, \$2.00. Traphagen, 1850-A W. Cermak, Chicago 8.

JOBS: High pay. Foreign countries, U.S.A. All trades. Write Dept. 55C, National Employment Information, 1020 Broad, Newark, N. J.

AMERICAN—Overseas jobs. Higher pay. Transportation, benefits. Men-women. All occupations. Details. Write: Employment Headquarters, 79 Wall Street, Dept. B-12, New York 5.

LATEST Foreign jobs! Highest wages. Unlimited opportunities. Laborers, clerical, construction, electronics, oil fields, civil service. \$2.00 (c.o.d.'s accepted). America's leading overseas employment researcher. Plus newest South American, Alaskan, Venezuelan listings. Universal Research, Box 4912, Baltimore 20, Md.

CONSTRUCTION Job lists: Alaska, Hawaii. Latin-American information. Each \$2. 216-MB Jackson, Chicago 6.

GOOD Salaries—Petroleum, construction, manufacturing, teaching, etc. Technical, professional personnel. Travel paid, living allowances, bonuses. U.S. tax exempt. Information \$2.25 air mailed. Colombian Opportunities, Apartado Aereo 14448, Bogotá, Colombia.

JOBS On ships and yachts traveling foreign countries. Davenport's, 1334-K, G.P.O. New York 1, N. Y.

MERCHANT Marine jobs! Top wages, men and women. Travel! Details 10¢. Captain, Box 501-P, Reading, Mass.

HIGH Pay overseas, domestic jobs. Men, women. Generous benefits. Companies pay transportation. For information write: World Wide, Dept. B3, 149 N. Franklin St., Hempstead, N. Y.

150s GOVERNMENT Jobs. Civil Service security. Overseas, in States. West Point-Annapolis entrance. Learn how to come out high in exams. \$1 starts you. Tole House, Box 2521M, Hollywood 28, Calif.

HIGH Paying jobs. Travel, adventures, world wide, Alaska, Japan, South America, Far East, Europe. All ages, skilled and unskilled. Thousands of positions open, and jobs on ships. Write for free information today to: International Employment Information Center, P.O. 115, Boston 27, Mass.

FOREIGN Employment information. Work overseas. Travel, adventure. Europe, Africa, Asia, Canada, Alaska. Earn as much as \$1,600 monthly. Construction men, truck drivers, clerks, teachers, professionals, etc. Fabulous opportunities. Most complete information, application blanks, etc. Sent by return mail same day received. Send \$2.00 to Dept. PM, Foreign Bureau, P.O. Box 512, New Orleans, Louisiana.

FREE Information—U.S.A., overseas jobs. High pay, transportation. Futures, Dept. M, 215 West 34th Street, New York City 1.

JOBS On ships. \$100 weekly, beginners. Travel, adventure. Write: Seamen Service, Box 17-M, Brooklyn 8, N. Y.

FOREIGN Jobs—Latin America, Alaska, Canada, up to \$1500 monthly. Up-to-date 1960 foreign service directory gives complete information: hot list of firms hiring for military and civilian construction, aircraft, oil, exporters-importers, mining. How-when-where to apply. 12th successful year. \$1.00. Global Reports, Box 8873-S, Los Angeles 8, Calif.

SPECIAL SERVICES

IRISH Coats of Arms booklet of officially recorded family names. Guaranteed accurate and authentic. \$1.00. Pioneer Arms, 65 Tenaflly Drive, New Hyde Park, N. Y.

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INFORMATION On anything. Ferguson Research Specialists, 116-14 141 St., South Ozone Park 36, N. Y.

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GOOD Paying jobs open! Operate, repair heavy earth moving equipment! Learn "on the job" operating latest cranes, bulldozers, earth carriers! V.A. approved. Free catalog. Write: T. I. Hutch, Greer Technical Institute, Braidwood, Illinois.

BE A locksmith! Earn while you learn. Big opportunities await you in this fascinating, profitable trade. Earn quickly—step into a wellpaid job or start a business of your own, full or part time. Learn easily at home, all materials and special tools supplied. Write for free book today! Locksmithing Institute, Dept. 6709, 150 Park Avenue, East Rutherford, New Jersey.

NEW Self-teaching course in memory helps you achieve greater success in business and social world. Free booklet. Memory Studies, 835 Diversey Parkway, Dept. 3436, Chicago 14.

CERAMICS Terrific hobby. Home study course \$2.00 postpaid. John's Ceramics-P, Box 878, Omaha 1, Nebraska.

FINGERPRINTING Course \$12.00. Diploma awarded. Details free. Alabama School of Fingerprinting, Box 185-A, Fairfield, Alabama.

LEARN Expert cake decorating, candy making. Free details to housewives! Candy & Cake, Dept. 737, Fallbrook, Calif.

OIL Coloring photographs—A fascinating hobby or profitable sideline for those with artistic talent. Learn at home. Easy simplified method. Free booklet. National Photo Coloring School, 835 Diversey Parkway, Dept. 3436, Chicago 14.

GAME Warden, government hunter, forestry, park and wildlife service announce job openings regularly. Enjoy outdoor work, good pay real security. Complete information free! Write North American School of Conservation, Dept. 179B, 810 Midsworth, Covina, Calif.

CIVIL Service. Learn about this field of work and how you can prepare yourself by home study for a high entrance mark. Private organization. Free booklet. No obligation. Franklin Institute, Dept. W20, Rochester 4, N. Y.

STUDY At home for personal advancement and spiritual unfoldment. Systematic study of Metaphysics or Metaphysical Psychology may help solve mental worries. Correspondence only. Free booklet. College of Universal Truth, 23 East Jackson, Dept. 3, Chicago 4, Ill.

MASTER Watchmaking at home. Free sample lesson. Chicago School, 2328-YJ Milwaukee, Chicago 47.

OPERATE Restaurant or diner. Free booklet reveals plan. Write School of Restaurant Business, Dept. KC-359, 335 W. Madison, Chicago 6, Illinois.

ENGINEERING And art degrees earned through home study. Electronics, electrical, mechanical, civil, physics, liberal arts. When writing, specify course desired. Pacific International College of Arts & Sciences, primarily a correspondence school. Resident classes also carried. 5719-B Santa Monica Boulevard, Hollywood 38, Calif.

DENTAL Technician's manual. Send only \$2.98 for "The Know How of Artificial Denture Construction." Ten complete chapters, easy to understand. Authentic, illustrated information direct from a dental laboratory. Grant Dental Laboratory, Haas Bldg., Los Angeles 14, Calif.

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MATHEMATICS, Science, business home study courses. Free catalog. Technical Training Service, Department 146MF, Brooklyn 14, New York.

USED Correspondence courses, books. Satisfaction guaranteed. Catalog 10¢ refundable. Courses bought. Bayles, 78-B Courtright, Wilkes Barre, Penna.

POPULARITY Through music! Make new friends. Earn extra money. Learn accordion, guitar. Easy lessons. Instrument furnished. Satisfaction guaranteed. Free information. National Conservatory of Music, P.O. Box 1938, New Haven, Connecticut.

SLEEP And learn. School subjects, personality improvement, foreign languages, financial security. Simple. Inexpensive. Free details. Mass Distributors, Box 26A, Cambridge 41, Massachusetts.

CHA Cha! Foxtrot! Jitterbug! Free lesson proves you can! Castle, 507 Fifth Ave., New York 17.

EARN College degree or diploma. Educational Bureau, P.O. Box 281, Essex Sta., Boston, Mass.

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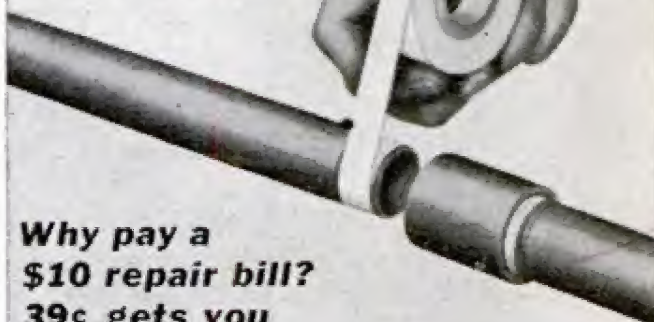
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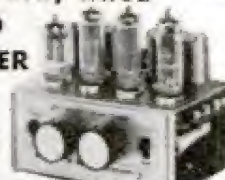
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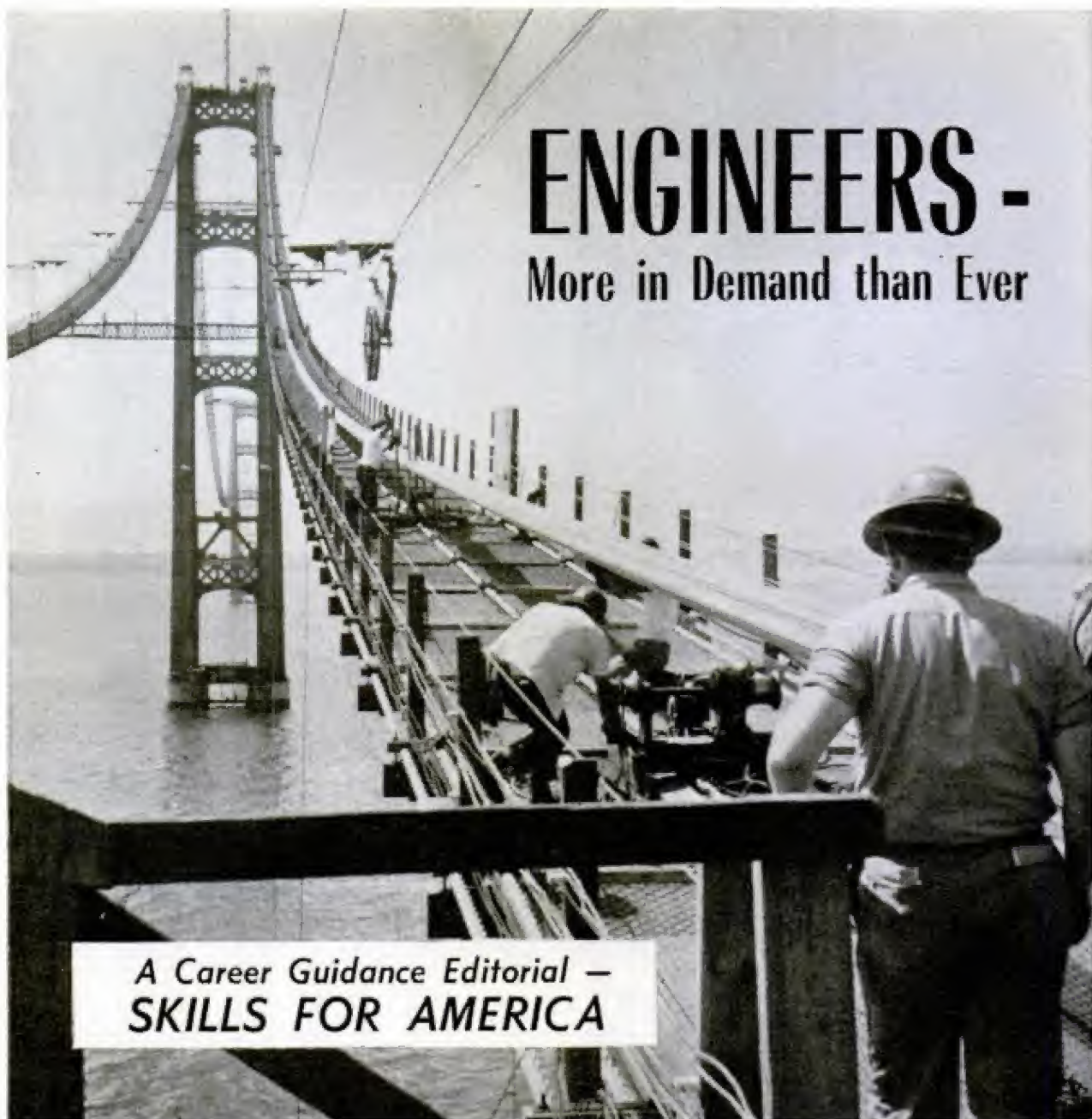
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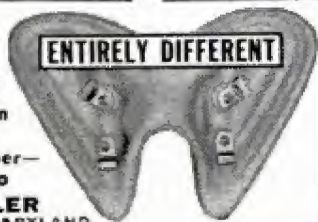
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(Continued on Page 70)

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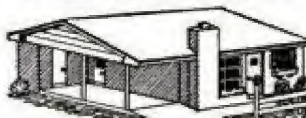


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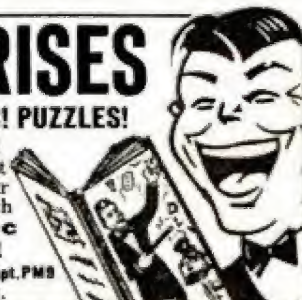
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Spotlight on the
DKW 750

By Art Railton

STYLED WITH an American touch, the DKW 750 is, under its sheet metal, as different from the American idiom as a car can be. Looking at it, however, you couldn't guess it.

Complete with tailfins and diagonal front fenders that give it the Yankee "lunge," the small car has its trunk in back where a trunk belongs, according to the nearest bellhop.

But once you pull into a gas station, you realize something's different. Printed on the gas cap are detailed instructions as to fueling procedures. Being a two-stroke with three cylinders, the engine requires that oil be added to the gasoline as in an outboard (or some lawnmowers). No mixing is required, however. You dump in a pint of oil for each five gallons of gasoline and the mixing is accomplished automatically.

Since pints of oil of the right type are not always easy to come by, 'tis best to stow in the trunk a carton of DKW's special two-cycle oil (it comes in pint cans).

The two-cycle design is simplicity itself, as you probably know. It has no valves, no camshaft, no rocker arms, no push rods, no valve springs, no timing gear, no valve lifters. There are only seven moving parts in the basic engine: Three pistons, three connecting rods, one crankshaft.

The fuel-air-oil mix is drawn into the combustion chamber through slots in the cylinder walls. When the piston is up, all openings are covered; when it is down the exhaust and inlet ports are open. Unlike a four-stroke engine (in which combustion

(Continued to page 74)



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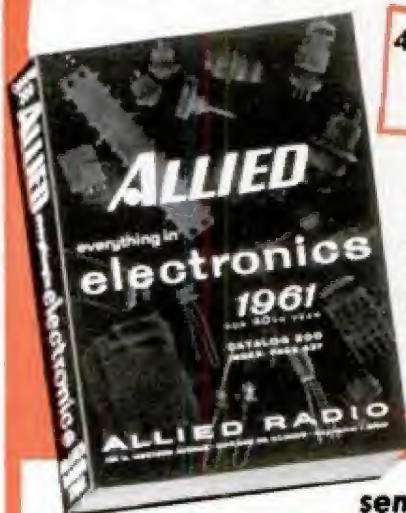
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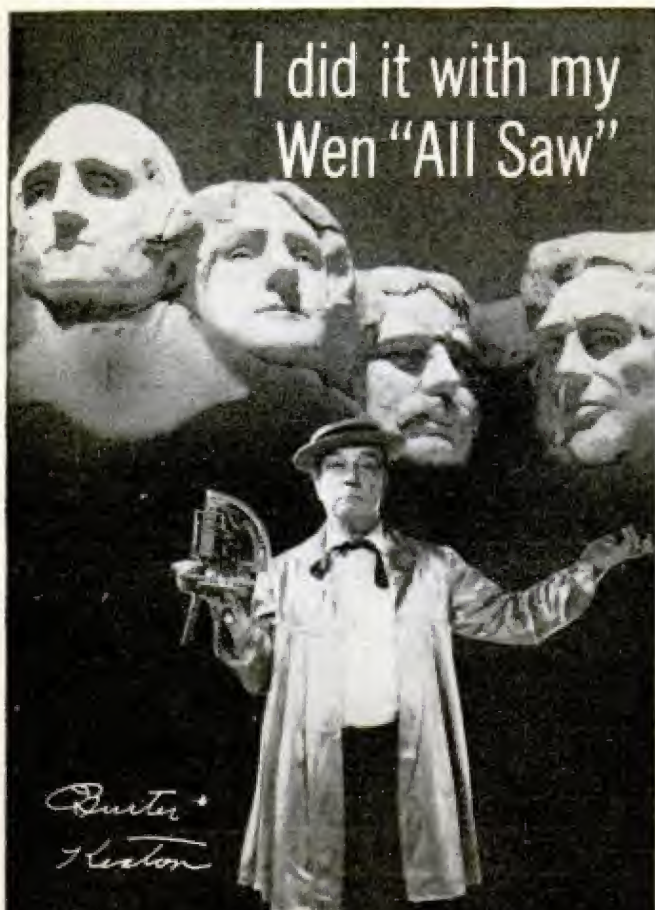
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occurs on every other down stroke), a two-stroker fires on each down stroke. Thus the expression "three equals six," meaning the three cylinders fire as many times per engine revolution as a six-cylinder engine.

Engine lubrication comes from the oil in the fuel mix. There is no crankcase sump and no oil level to check or oil to change. You simply add oil each time you buy gas.

First shown in prototype at the Frankfort Show in 1957, the DKW 750 is just now becoming available for sale over here. Its engine is exactly square with a bore and stroke of 2.68 inches. Displacement is 45 cubic inches, horsepower is 34.

Mounted ahead of the front axle, the engine drives the front wheels. The floor, front and rear, is flat, there being no need for a tunnel. Front brakes are mounted in-board and have finned drums. Front suspension is by longitudinal torsion bars (similar to Chrysler's). The rear axle is a solid bar and rear springing is by a transverse torsion bar tied to the wheels by trailing arms.

Unlike most small cars (wheelbase is only 85.5 inches, over-all length 13 feet 1 inch), the 750 has a separate frame consisting of two box-section side rails that belly outward amidships like a Ford's. The body panels bolt together for easy replacement and the assembly bolts to the frame in conventional Detroit fashion. It comes only as a two-door sedan (sun roof optional).

Steering, by rack and pinion, is precise. The DKW goes where you aim it and, if you keep your foot on the gas pedal, it will go around corners at about any speed you are brave enough to try. The front wheels pull it around in a most confident manner.

So far so good, you say. Is everything perfect? Of course not. Most obvious deficiency is a steering-column shift so clumsy to use you find yourself wishing for an automatic transmission. Perhaps the test car was an exception (it was brand new), but the linkage was about as uncooperative as it could be. Getting through the gears is not the crisp pleasure it should be in a car that otherwise handles as well as this one. Reverse is especially stubborn. Not only are the gears hard to find (the whole pattern is located too high, being atop the column rather than beside it), but the physical effort is too much for fast gear changes. There's no two-finger shift here, no flipping, no boy-is-this-fun feeling at all. However, all four gears are synchromesh and you can drop into first gear (if you can find it) while rolling, an excellent advantage in any small-engined car.

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(Continued to page 76)

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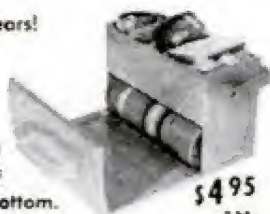
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fast, hard-driving country test (with gusty winds and temperatures about 50), the DKW 750 averaged 26.3 miles per gallon. Much of the test was at full throttle with numerous hard accelerations. In a city-driving test with four stops per mile and an over-all average of 16 miles per hour, the car did better, getting 27.6 miles per gallon.

Top speed is about 67 miles per hour, true, although the day was so windy with unpredictable gusts that this figure should not be taken precisely. From 0 to 30, the average was 5.5 seconds; from 0 to 60 it was 31.6 seconds. The car moves away fast enough for normal American traffic.

At high speed it is quiet and stable with little or no wander even under gusty conditions.

Poorest part of the car is its bodywork with door and window operation being stiff and laborious. All seats are well shaped and comfortable, but the front seats tilt backward too much for this driver. Fore-and-aft adjustment is also an effort. The passenger's front seat has a catch to hold it to the floor in case of sudden stops. To pivot the seat forward for access to the rear seat, you release a floor knob. The catch seems too flimsy to hold it in any serious accident.

Some small items:

Turn signals (control is to right of steering column rather than left) don't cancel themselves. Wipers are fast, but noisy. The ignition lock is located close to the steering column at a spot virtually impossible to see without craning your neck. The wheel is elliptical on one side.

To the left of the wheel is a headlight dip switch. It allows you to depress your headlamps without kicking around at the floor for the button. The switch also has a spring-loaded position so you can flash the lights on and off during the day as a signal when overtaking or to warn a car that you're coming through fast and furious.

Heater is adequate, but that's all. The trunk is more than adequate by European economy-car standards.


Riding quality is good on the boulevard, rather hard and stiff on rough stuff.

Altogether here is a car that will take you around in comfort and security on all types of road conditions. It is especially good on ice and snow thanks to its front-wheel drive. It does have some disadvantages (biggest, perhaps, being the two-stroke fuel problem). However, you soon learn to take this in stride. Except for hard-to-use doors, windows and shift lever, it is a car that will be easy to live with and will provide excellent short-haul usage as well as highway usage economically and with considerable comfort. Price is \$1723 at the port of entry. ★ ★ ★

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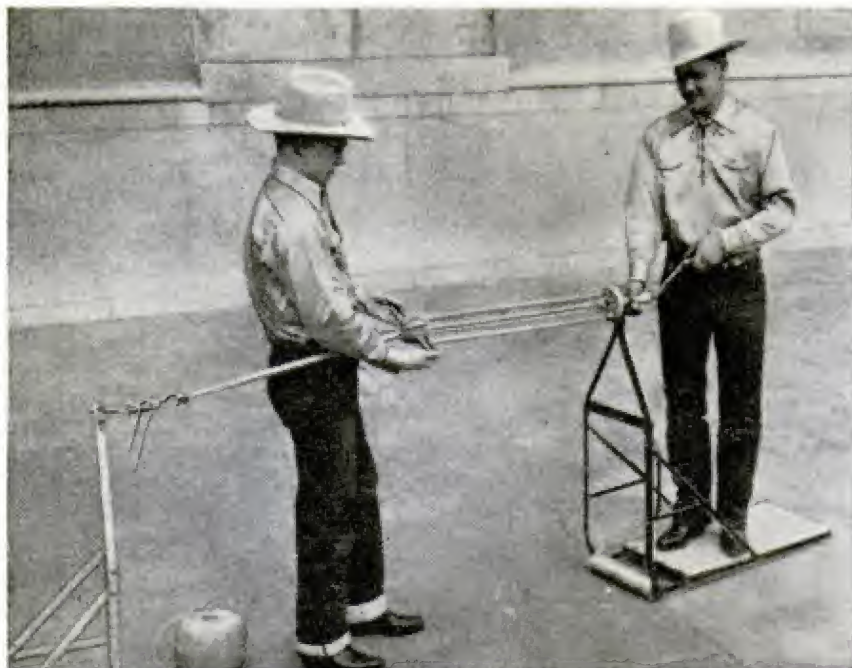
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Uses up to 200 watt bulb. Grid costs 10¢ per month. Complete with fly attractor. Dead insect catcher. Write to **SING SING BUG CHAIR, INC.** BOX P 3708 / OAK PARK 37, MICH.



DEALER
FRANCHISES
in some territories
STILL AVAILABLE

New, Colored Aluminum Roof Coating and Resurfacer



Johnston Foil-Gard

Write Dept. 31, The R. F. Johnston Paint Co., Cincinnati 12, Ohio



Arthur Behn brushes on a new pebble white roof with Foil-Gard Aluminum Paint, a product of the R. F. Johnston Paint Co., Cincinnati, Ohio.

What's new at 6700 Bantry?

JOHNSTON FOIL-GARD COLORED ALUMINUM PAINT RESTORES 12-YEAR-OLD ROOF

The Arthur E. Behn residence, 6700 Bantry Ave., Cincinnati, needed a new roof. Appearance was dingy—leaks had developed. Mr. Behn found the economical solution: He simply brushed on a new roof. He used Foil-Gard, a colored, fibrated aluminum coating made with ALCOA® Pigments. We talked recently with Mr. Behn, who had this to say:

"Foil-Gard went on very easily—even covered the dark exposed edges of the shingles. I chose *Pebble White* Foil-Gard and my new roof just looks fine. In fact, the neighbors were all out to see my latest do-it-yourself project. The shingles are at least 12 years old, maybe 15. Now I expect another 8 to 10 years of life from this old roof."

A safe prediction, Mr. Behn. Here's why. Aluminum coatings like Foil-Gard protect in any climate . . . stay firm on top, soft and pliant underneath . . . will not run or crack. One coat seals any surface, bridges small cracks and nail holes, keeps shingles in place.

There's a choice of harmonizing, fadeproof

colors that stay new-looking for years. In fact, weathering actually intensifies the colors. And reflective aluminum pigment turns back much of the sun's heat, helps keep interiors cooler in summer.

Ideal for composition, metal, slate, tile, tar paper roofs . . . brick, masonry, concrete or metal siding. Apply with brush, squeegee or heavy-duty spray equipment. Ask your dealer for Foil-Gard or one of the other fine brands made with ALCOA Pigments.

Alcoa does not make roof coatings, but we will be happy to refer you to reputable manufacturers who do. Send coupon for our booklets.



For exciting drama watch "Alcoa Presents" every Tuesday, ABC-TV, and "Alcoa Theatre" alternate Mondays, NBC-TV

Aluminum Company of America
1748-J Alcoa Building, Pittsburgh 19, Pa.

Please send your free booklets:

- ☐ *Painting With Aluminum in Color*
- ☐ *Aluminum Roof Coatings Make Time Stand Still*

Name _____

Company _____

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City _____ Zone _____ State _____

GUESS THE YEAR

A PATENT QUIZ

By Rick Krepela

Try this quiz to see how well you can pinpoint the dates these common items were **FIRST** patented. Some are older than you think—others fairly recent. All were granted patents here in America. See how close—give or take a few years—you can come to guessing the year.

1. A mechanical refrigerator for the "artificial production of ice."
2. A self-winding clock: a forerunner of the self-winding watch.
3. A method to adjust the angle of the slats on Venetian blinds.
4. That American tradition—the soda fountain.
5. The familiar fountain pen.
6. The photographic flash bulb.
7. A "compound for culinary use" called oleomargarine.
8. The "pour lip" on the everyday screw-cap bottle.
9. A "device to bake waffles"—the first waffle iron.
10. Canning—a process to "preserve . . . in tin."
11. The first machine to show animated pictures or movies.
12. A machine to make threaded metal screws for use in woodworking.

Now look below to see how well you did.

ANSWERS TO "GUESS THE YEAR" QUIZ

1. Refrigerator—Patent No. 8080 granted to Dr. John Gorrie in 1851.
2. Self-winding clock—An exclusive 14-year patent right from Connecticut granted Benjamin Hanks in 1783. According to the application the clock "winds itself up by the help of air."
3. Venetian blinds—U.S. Patent No. 2223 granted John Hampson in 1841.
4. Soda fountain—Jacob Ebert and George Dulty obtained the patent in 1833.
5. Fountain pen—1830 is the date here; to a Mr. D. Hyde of Pennsylvania.
6. Flash bulb for photography—Not until 1930 on this one when Johannes Ostermeier took out patent No. 1,776,637.
7. Oleomargarine—Henry Bradley was issued patent No. 110,626 in 1871.
8. Pour lip for bottles—Patent No. 2,039,345 granted Edward Ravenscroft in 1936.
9. Waffle iron—1869 is the date here; to Cornelius Swarthout of Troy, N.Y.
10. Canning in "tins"—Ezra Dragget got an earlier start than you would think. The patent was granted him in 1825.
11. Animated "movies"—A device called the "wheel of life," showing "moving drawings" through a slit was patented by William Lincoln in 1867.
12. Screw machine—David Wilkinson took out his patent on his crude but workable machine in 1798.

100% FRESH STARTS



There's just no substitute for a fast start when the occasion calls for it. (Ask any car owner!) And you *get* fast starts from a Delco Dry Charge battery—because a Delco DC is 100% FRESH. It's not activated until you buy it—so you get all the power you pay for. Better yet, you can count on a long life of dependable starts from this battery because it's specifically designed to handle the increased electrical needs of today's high compression engines.

Don't take a chance—ask your regular serviceman for a Delco DC-12, the battery built by Delco-Remy, world-famous manufacturer of a complete line of automotive electrical equipment.



DELCO BATTERIES ARE
ANOTHER RELIABLE
GENERAL MOTORS PRODUCT
... DISTRIBUTED NATIONALLY
THROUGH



BE ON TV...
ask your **DELCO** dealer about the
exciting Hollywood TV contest

Get satisfying **flavor**...so friendly to your **taste**!

NO FLAT "FILTERED-OUT" FLAVOR!

NO DRY "SMOKED-OUT" TASTE!



Never too strong.
Never too weak.
Always just right!

You can light either end!

See how Pall Mall's famous length of fine, rich-tasting tobacco travels and gentles the smoke—makes it mild—but does not filter out that satisfying flavor!

HERE'S WHY SMOKE "TRAVELED" THROUGH FINE TOBACCO TASTES BEST



1 You get Pall Mall's famous length of the finest tobaccos money can buy.



2 Pall Mall's famous length travels and gentles the smoke naturally...



3 Travels it over, under, around and through Pall Mall's fine tobaccos... and makes it mild!

OUTSTANDING...and they are MILD!

© A. T. Co. Product of *The American Tobacco Company*—"Tobacco is our middle name"

WRITTEN SO YOU CAN UNDERSTAND IT
VOL. 114 NO. 3

We're Listening for Other Worlds

By
Clifford B. Hicks

ONE DAY early in April a prematurely-gray young man handed his assistant a list of figures. The assistant fed the information into the controls of a huge radiotelescope which swung around until it was aimed at a point low in the southern skies.

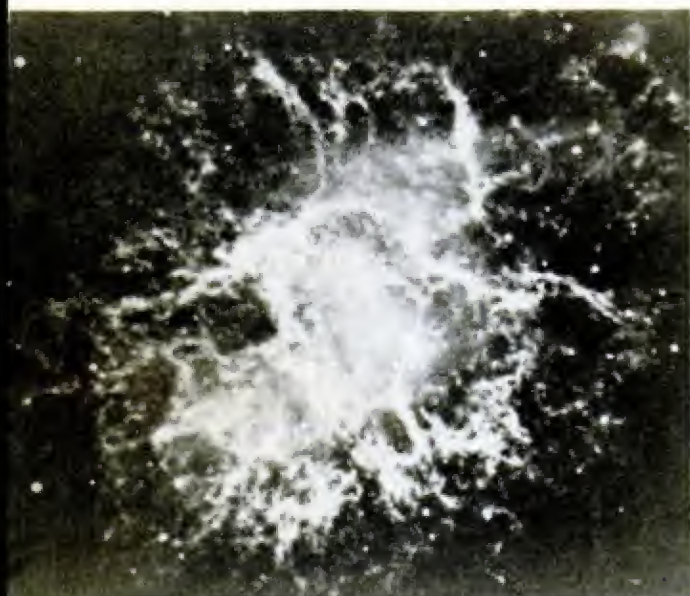
Thus began one of the most fascinating experiments—and perhaps the most significant—in the history of man.

The young scientist was Dr. Frank Drake. At that moment, as every science-minded newspaper reader now knows, he began listening for signals from intelligent beings elsewhere in the universe. Many of our foremost scientists endorse the experiment, and have faith in its ultimate success.



Dr. Frank Drake, in charge of the program, is aiming the 85-foot radio "ear" at two nearby stars





Exploding stars (an example is the Crab Nebula at left) splash incredible clouds of luminous gases into space. Gases form clouds of matter, right, which may condense into new stars with all the elements necessary for life

The experiment sounds like cockeyed science fiction, but there is not the slightest doubt in Drake's mind that eventually it will succeed. When a signal is received, it will touch off a revolution in thought. No longer will man be alone in his universe. And no longer can he consider himself the most advanced of all creatures.

"When that message comes in," says Dr. Drake, "we won't know what kind of a creature transmitted it. Could even be a porpoise at the bottom of some other-world ocean. But we *will* know one thing. The signal itself will prove that it came from a more intelligent being."

We then will be faced with the indisputable fact that there are other beings, superior to us in intelligence and scientific achievement, living in their own civilization on their own planet spinning around their own sun.

Why is Frank Drake so sure that he (or someone following in his footsteps) will receive a signal from another intelligent creature? The answer is found in a scientific revolution, a revolution that has passed right over the heads of most of us who are too busy contemplating the crabgrass in the lawn or the changes in the TV schedule to lift our eyes to the stars.

Actually it is a two-front revolution. One involves the great strides made in *cosmology*, the study of the universe and its origin. The other involves new work in *biochemistry*, the study of the origin and development of life.

Cosmologists have developed new theories, based on strong scientific evidence, as to the origin and evolution of the universe. Naturally there is some difference of opinion among the scientists themselves.

According to one theory, the universe billions of years ago consisted of a cloud of hydrogen atoms, a cloud so incredibly thin that we would consider it an absolute vacuum. Over a period of billions of years, a few of the atoms, quite by accident in their random wanderings, drifted together, forming an invisible wisp in the thin cloud. Once formed, it began pulling in more and more particles. The growth accelerated.

Clots and eddies started spinning through the cloud, apparently at random but governed by natural laws. An arm thrust out here, a whirling ball there. The clots themselves united into larger forms. The whole cloud shrank as the incredible gravitation increased. And as it shrank, the temperature and pressure built up.

Shaking with convulsions, unstable, wracked by great currents of energy, the cloud in effect exploded over an incomprehensible period of time. Great gobs of matter splashed out into the wastelands of space. Each spinning gob was an embryo galaxy, an island universe.

One of these gobs measured 300,000 to 500,000 light-years in diameter (a light-year is six trillion miles). As it spun, it contracted, making it spin all the faster. The subcloud took on the form of a disk with spiral arms. At last it reached a steady state, spinning off into space. Thus was born the Milky Way, our home galaxy.

Within the range of our telescopes are at least half a billion such galaxies, all rushing away from us at incredible speeds. Some, in the far reaches of space, pass "over the horizon" of the universe. We'll never see them again no matter how we refine and improve our telescopes. Their light simply can never catch up with us.



Our Sun is quite an ordinary star far out toward the fringes of a spiral galaxy somewhat similar to this

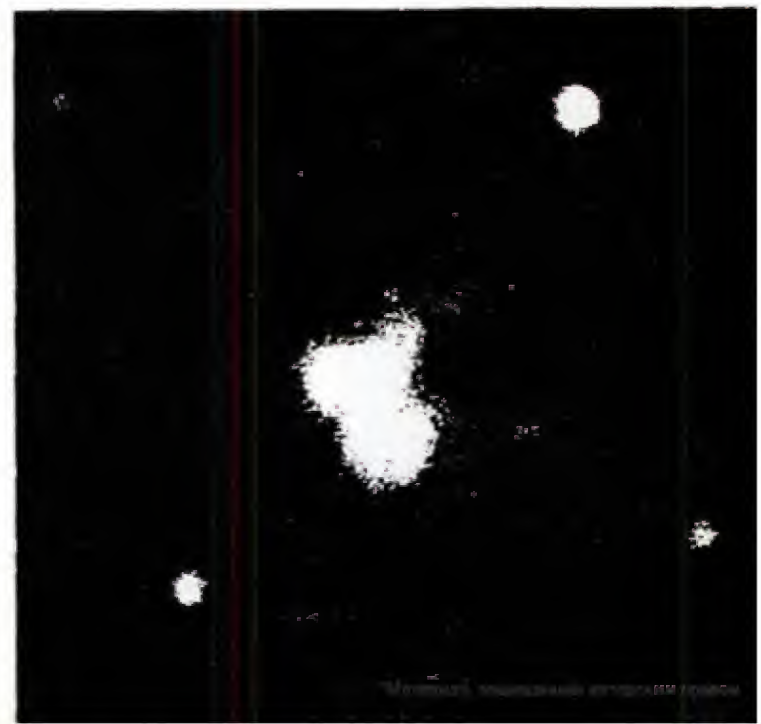
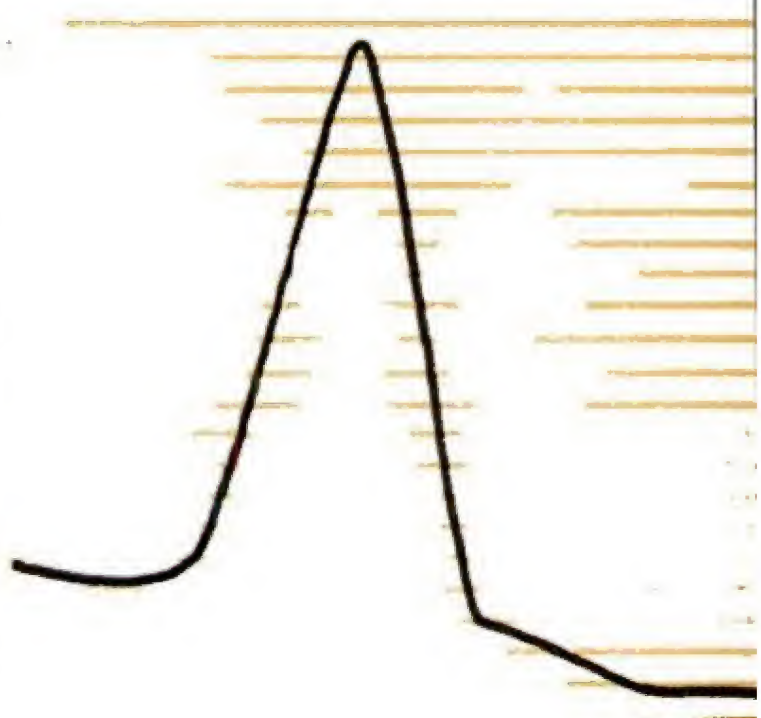
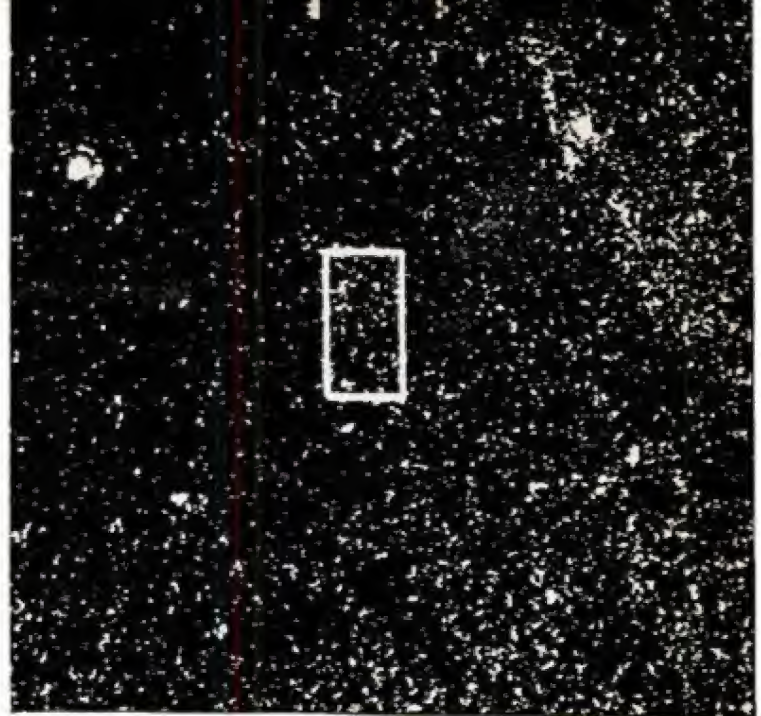
Indeed, these disappearing galaxies are a key part of another theory. According to this belief, the universe is a self-regulating system. As fast as old galaxies disappear, new ones are born. Although the rate of "birth" is extremely slow, it requires the creation of enough matter *every second* to make 50,000 suns. This is the "steady state" theory, and it describes a universe which continually sheds matter and simultaneously gives birth to the same amount.

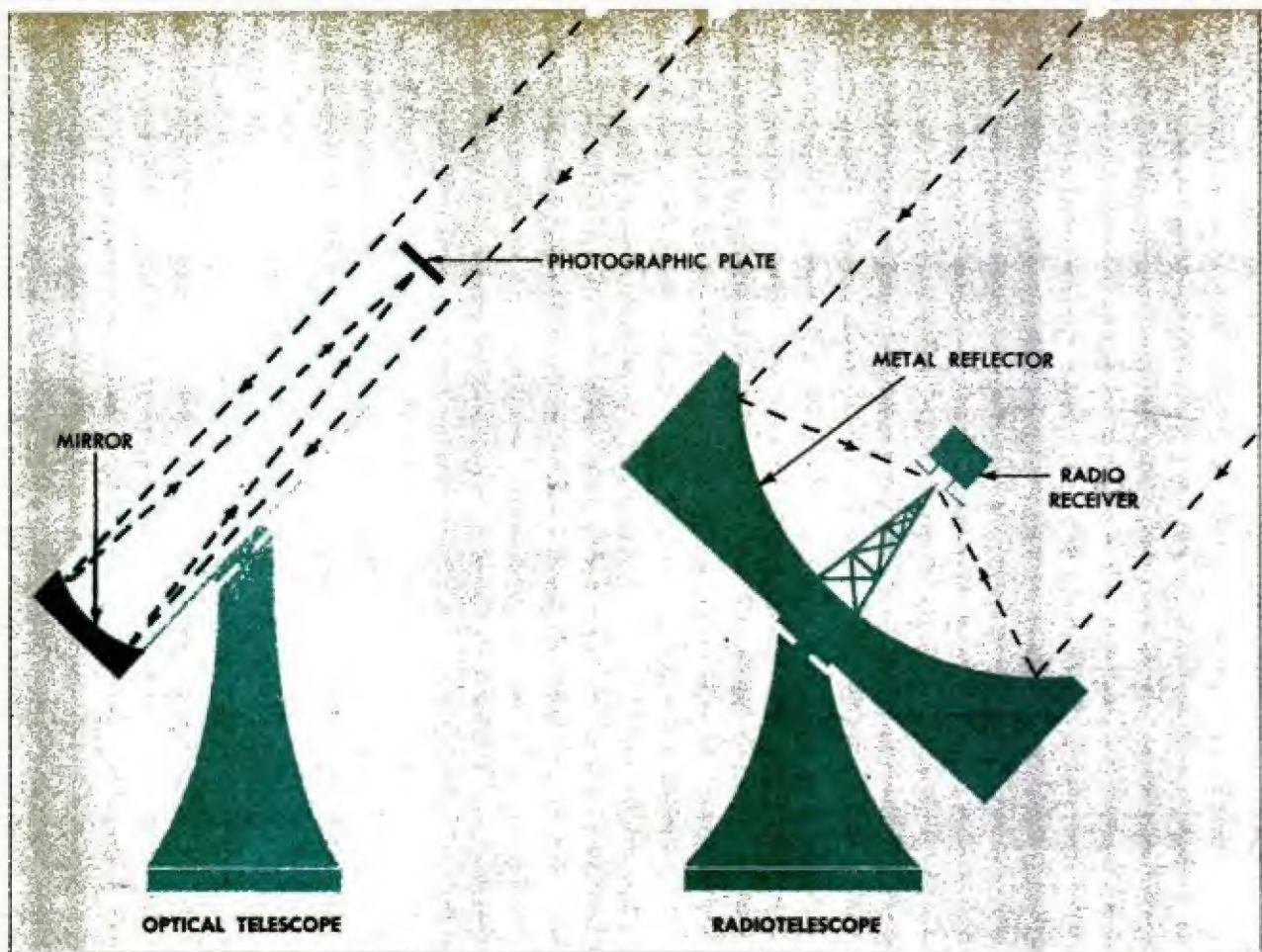
Right now, the Navy is using radiotelescopes to test this steady-state theory. The huge instruments pick up the "music of the cosmos"—noises that sound like gravel on a tin roof. If the scopes discover that some of the noise is caused by a particular type of X ray, it will be strong evidence that galaxies are going through their birth pangs right now, and we are listening to the whisper of creation.

Far out on the edge of our galaxy when it was born, an insignificant event occurred. Some of the gas swirled into a tiny eddy. Gradually the eddy shrank, and the smaller it became the higher went the temperature, until the high temperature touched off a process of nuclear fusion deep in the interior. The ball of gas began to throb. Eventually it settled down to a steady glow. Thus was born our Sun.

Our Sun is a "second generation" star, though, and we must look first to its forebears. Astronomers have known for some time that stars have a definite life; a typical star may live for 10 to 12 billion years.

Power of radiotelescope is shown at right. Top photo was made with an optical telescope. When radiotelescope revealed intense activity, as shown on graph, optical astronomers concentrated on specific area and made bottom photo of two galaxies in collision





Optical telescope and radiotelescope are similar except that optical telescope gathers only light waves, while a radiotelescope gathers and focuses all radio waves, thus giving us a bigger window to the universe

←Here's the complete electromagnetic spectrum. Note what a very small part of it we actually can see. Dr. Drake is "listening" at 1420 megacycles as shown, considered the "universal wavelength" because it is radio-emission line of hydrogen, the parent element

Below, our neighborhood, astronomically speaking, shows Sun and two stars which will be checked first

From model by Sarah Lee Lippincott, Sproul Observatory, Swarthmore College





Meteor darts through sky over Hollywood. Large organic molecules, similar to those that are believed to have evolved into life on Earth, have been found in meteorites. Can this be way life spreads through universe?

As death approaches, it begins to expand. eventually exploding and then shrinking into a dead star perhaps half its former mass. But what happened to the other half of its material? This was ejected back into the vast dust clouds of the galaxy.

But now there is a difference. Originally the material was hydrogen gas. When the hydrogen was "burned" in the parent star, some of the atoms were altered. Atomic particles were lost and captured. The new cosmic dust, ejected from the exploding star, contains helium, nitrogen, iron, uranium and all the other known elements.

When a "second generation" star, such as our Sun, is born of this dust, it contains these heavier elements—which are vital to life processes.

As this cloud of dust condenses into a star, swirls and eddies are "left behind." These continue to circle the new-born star, contracting and condensing into a swarm of planets. Thus was born the Earth.

Not long ago, astronomers believed the Sun was an accident of the universe, that no other suns had planets. Today most astronomers are convinced that an incredible number of stars have swarms of planets. Instead of being unique in the universe, our Sun and its planets are just plain common. The Earth is no accident; it probably is duplicated countless times in our own galaxy.

The resulting picture of the universe may be difficult for man, the egotist, to accept. We live on a minor planet whirling around a commonplace star that exists near the edge of a galaxy of 100 billion stars. Harlow Shapley, one of the greatest of all astronomers, estimates that within reach of our present telescopes there are more than one hundred thousand million billion stars (if you write this in figures, it is 10 followed by 19 zeros).

How many of these stars have planets suitable for life—at least the form of life that we know?

This brings up the second scientific revolution—the new theories of biochemistry. What is life? What are its essential ingredients? How did it start?

Most biochemists now believe that life started from complicated molecules—amino acids—that were formed in the early cooling-off period of our planet. Such molecules have an inherent ability to grow and, in a sense, to reproduce.

At the University of Chicago, Stanley Miller made studies which indicate that these complex molecules *could* have been formed in tremendous quantities as the Earth condensed. Dissolved in the oceans, they formed a vast "organic soup." Eventually, through a combination of random "accidents" which may have included an

(Continued to page 220)

Dr. Wernher von Braun, one of the scientists responsible for developing the German V-2 rocket during World War II, is now a U.S. citizen. He directed development of the Jupiter C ballistic missile and launching of Explorer I Earth satellite



My Most Exciting Moment

By Dr. Wernher von Braun

ON THE NIGHT of the historic launching of the U.S. Army's scientific earth-satellite, EXPLORER I, I sat in the Communications Center of the Pentagon watching the teleprinters as they clacked out the progress of the countdown underway at Cape Canaveral, Fla.

As the teleprinters raced to keep pace with the countdown, large screens reflected their messages. This one read:

HUNTSVILLE, ABMA-19, X-27 AND COUNTING AT 2221 EST. THE CAMERAMEN HAVE UNTIL X-21 TO FINISH THEIR JOB AND GET OFF THE PAD. EYEWITNESSES SAY THAT THE MISSILE IS A BEAUTIFUL SIGHT WITH THE SEARCHLIGHTS PLAYING ON IT. SERVICE STRUCTURE IS MOVING BACK INTO FIRING POSITION.

During the actual firing of EXPLORER I, Dr. William Pickering of the Jet Propulsion Laboratory, Dr. James A. Van Allen of Iowa State University and I were in Washington—to meet the press. We had been told in so many polite words that we had to sweat it out in the Communications Center of the Pentagon. In this way, if everything worked successfully, we would be readily available to go over to the National Science Academy to meet the press, newsreel, and television people. That's why I put on a dark suit. But, just in case things didn't come off so well, I had a pair of dark glasses with me and was determined to sneak away to a still darker movie theater.

At Cape Canaveral's Missile Firing Laboratory, Maj. Gen. John Bruce Medaris, who had decided to go ahead with the launching despite the high winds of the past two days, was now sweating out the countdown in a squat, unpretentious concrete blockhouse.

The teleprinter moved again:

HUNTSVILLE, ABMA-20—THE CLUSTER (the high-speed unit designed to impart a bullet-like spin to the satellite) IS BEING REVVED UP. 370 RPM NOW ... 440 RPM ... 470 RPM ... EVERYTHING IS GOING FINE. THE BLOCKHOUSE IS BUTTONED UP, THE COUNT IS X-7 AT 2241 EST ... X-6 AT 2242 ... EVERYTHING IS OPERATIONAL.

In the blockhouse Robert Moser pressed his earphones more tightly to his head, glanced at his countdown schedule, and directed the sequence recorders be turned on. He checked the control console.

X-2 MINUTES ...

In Moser's earphones the voice was jarring: "We have a jet-vane deflection!"

With 100 seconds to go, Moser spoke through his mike to Dr. Kurt Debus, Missile Firing Lab Chief. "What do you want to do?" he asked.

Debus's eyes bored through the window. "Forget it," he said.

"Rudder drive on!" Moser continued his countdown.

X-1 MINUTE . . . FINAL WEIGHT MEASUREMENT BEING TAKEN.
SPINNER STILL RUNNING SMOOTHLY.

The teleprinter raced to keep pace with the event.

At X-30, Moser began to call out the final seconds whipping by: "X-30, 20, 10, 9, 8, 7, 6, 5, 4, 3, 2, 1—Firing Command!"

A burst of flame roared out of the rocket. They say the rocket rose ponderously with awful majesty from the pad; picking up speed as it screamed skyward. The time was 10:48 p.m., Eastern Standard Time.

In the hot, crowded telecon room the teleprinter kept ticking out the good news that the big first stage was performing perfectly, that the rocket was slowly arcing out toward the Atlantic. At 155 seconds the first-stage power cut off—right on schedule. A few seconds later the nose section separated from the booster, just as planned. Ninety more seconds passed slowly before the teleprinter reported that the second stage ignition was "OK." Then for a whole minute there was silence.

I hurriedly penciled a message which flashed on the outgoing screen:

WASHINGTON DA-5, OFFICIAL FOR ABMA FROM PROF. VON BRAUN
DID THE 3D AND 4TH STAGES FIRE? (If the high-speed stages had not fired, there would be no orbit.)

HUNTSVILLE, ABMA-21, REF DA-5—DO NOT KNOW YET. WILL LET YOU
KNOW SOON AS POSSIBLE. GEN. MEDARIS SAYS HAVE A CUP OF COF-
FEE, SMOKE A CIGARETTE, AND SWEAT IT OUT WITH US.

Presently we had word from Antigua Microlock that both EX-
PLORER transmitters had been clearly heard passing that point. The
island of Antigua is about 1300 nautical miles downrange from Cape
Canaveral, and the time elapsed between the firing of the second stage
and the passing of Antigua was a pretty good indication of whether
or not the final speed of the fourth stage was at least in the right order
of magnitude for orbital flight.

As a result of the measured travel time between firing of the second
stage and the passing of Antigua, the data-evaluation group at Canav-
eral concluded the EXPLORER I had reached sufficient speed and must
have settled in a 106-minute orbit. But the evidence was still too ten-
uous to cheer.

It only gave us an indication in our Pentagon communications room
as to when to expect the first reports from California that the top stage
had really gone around the world!

Well, after the predicted 106 minutes were over, nothing happened,
and I can assure you those eight more minutes until something did
happen were the most exciting eight minutes in my life.

As the minutes dragged on without a signal reported from California,
our spirits sagged. At the end we were frankly desperate and yet we
couldn't show it because there was so much brass around. We had to
keep up appearances, and had to smile and convince everybody that
things were in perfect shape.

Bill Pickering had the West Coast on long distance—his four receiver
stations in California—and still none of the four had heard a thing.
That went on for what appeared to be hours. I heard Bill shouting
into the telephone, "Why the hell don't you hear anything?"

Then, suddenly, within 30 seconds all four stations came in and said
they had a clear signal! At this moment we knew that we were in the
satellite and space business.

Walter D. Brand

see ~~at~~ Nov 60, 10

AN EYE ON SPACE

By Dr. Dan Q. Posin

PROFESSOR OF PHYSICS, DE PAUL UNIVERSITY
SCIENTIFIC CONSULTANT AND ADVISOR, COLUMBIA BROADCASTING SYSTEM

A FRIEND OF MINE was saying the other night, "I don't see how the scientists can know the distance to the Moon—or to the Sun. And, when they talk about galaxies, how can anyone know how far they are? Have the scientists measured that far—with a tape?"

I don't blame him for being skeptical, but the fact of the matter is that it's not always necessary to measure distances in the way that you would measure the length of a table. There are other ways, some just as good, others better.

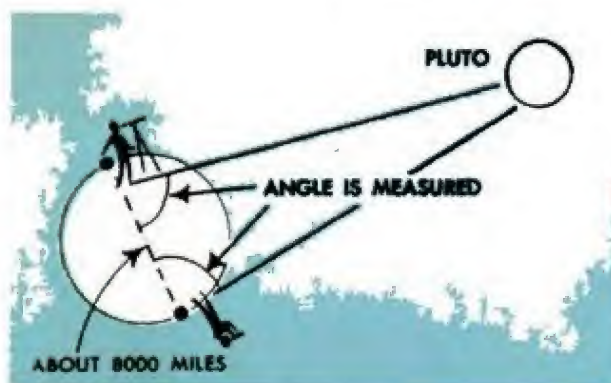
First, the distance to the Moon can be measured by aiming radio waves at it, and timing how long they take to bounce back.



In one such trial, the total time for the roundtrip was 2.4 seconds. This means, of course, that the radio waves took 1.2 seconds to go one way. They travel at the rate of 186,000 miles in one second, so the Moon was $186,000 \times 1.2$ or 223,200 miles away. Not many people would want to buy a tape that long and unreel it as they space-travel toward our satellite.

The distance to the planet Venus has been measured in the same way. And also the distance to the Sun. In this case, you might think that since the Sun is a gaseous body, the radio waves would not bounce back. But they do. Radio waves can be reflected by flames, cyclones, electrified regions, gases.

This radio method—or radar, if you like—does not work very well for our more distant planets. We do not have, as yet, enough radar power to send a radar beam strong enough to carry successfully, say, to the planet Pluto. So we measure the dis-



tance to Pluto this way: two men on Earth, widely separated, point their telescopes at Pluto and note their angle of tilt.

That's all there is to it. They have a triangle with one side, say 8000 miles and two known angles. It's simple to calculate the lengths of the other two sides. The distance to Pluto in this way comes out 3,600,000,000 miles.

When it comes to measuring the distance to the stars, our biggest base line (that 8,000 miles, the diameter of Earth) is not big enough. You can see what happens, of course, if you try to use this method to measure relatively great distances employing a relatively small base line. Your angles come out almost 90 degrees, and a slight error in the angles will give you an entirely different measurement on the two long sides of the triangle.

The remedy for this difficulty is to use a larger base line. Do we have one which is bigger than the diameter of Earth?

Of course we do. It is the diameter of the Earth's orbit around the sun. So, an astronomer sights on a star tonight; then,

(Continued to page 240)

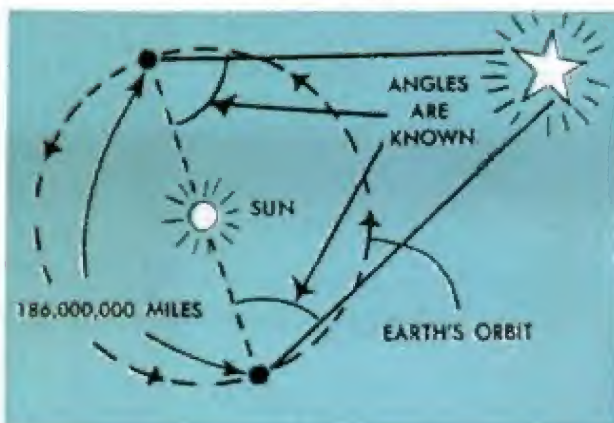
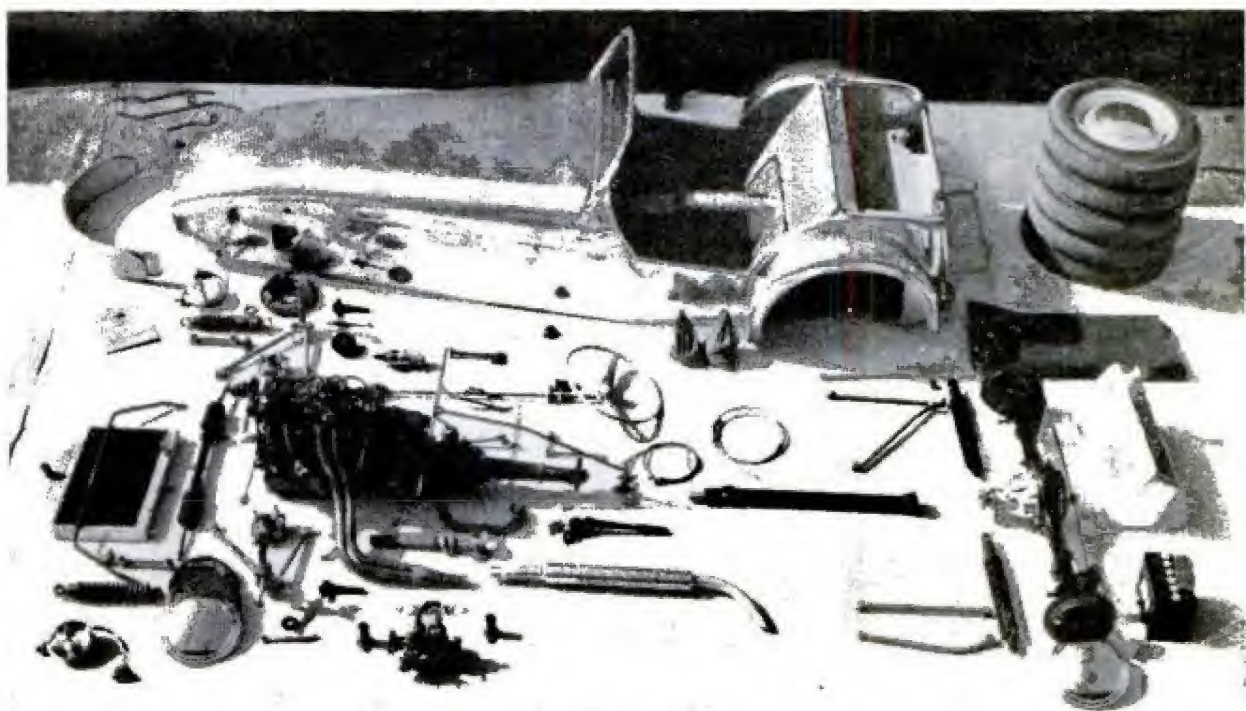
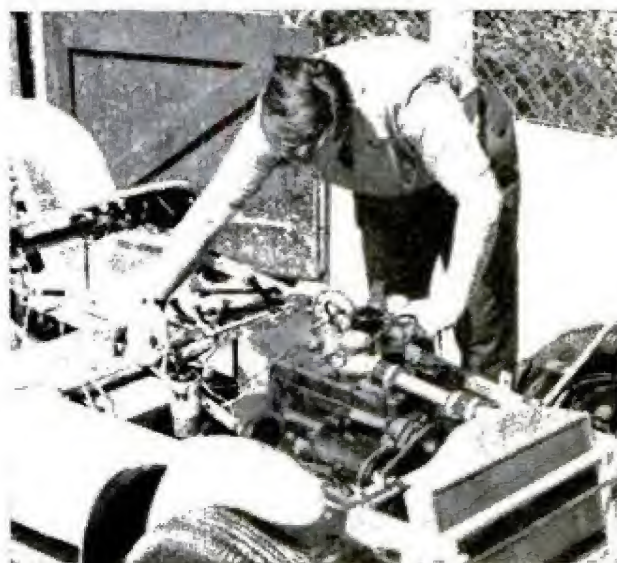




Photo Universal

Do-It-Yourself Car Kit

ALL THE COMPONENTS of this speedy little Lotus Seven sports car are included in a do-it-yourself kit. They can be assembled with a set of hand tools and a drill. While the completed car is sold in the U.S., the do-it-yourself kit is available only in England. For a nonmechanic, the job of assembling the car takes about 60 hours. The 825-pound Lotus has a wheelbase of 88 inches and is 123 inches long, 53 inches wide and 27½ inches high. Ground clearance is 5 inches. The kit model has a choice of a Ford 100E or Coventry Climax engine; a higher-compression Ford engine is offered the U.S. buyer. The Lotus can be fitted with a top that folds flush into the rear compartment. This fall, the import models will have a lefthand steering wheel.



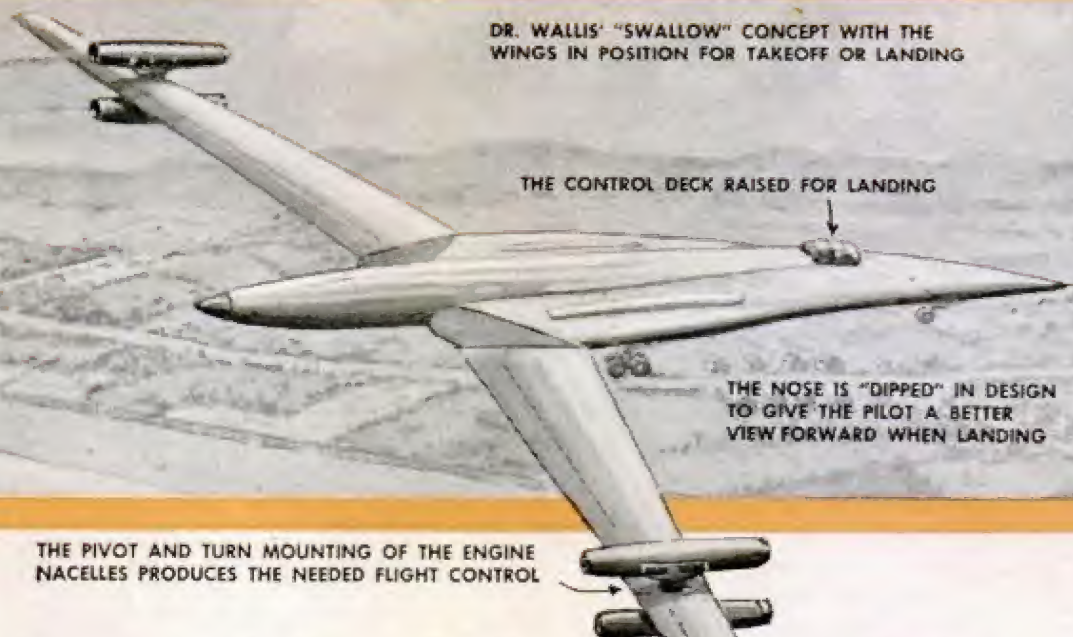
TO SECURE EARLY DATA, A SERIES OF EXPERIMENTS WERE CARRIED OUT WITH A LARGE PILOTLESS MODEL LAUNCHED FROM A ROCKET-PROPELLED TROLLEY. THE AIRCRAFT HAD A WINGSPAN OF 30 FEET AND WAS POWERED BY TWO ROCKET MOTORS AND RADIO CONTROLLED. THESE TESTS PROVED THE PRACTICABILITY OF THE REAR WING POSITION AND THAT THE AIRPLANE COULD BE MANEUVERED WITHOUT THE USE OF TAILPLANE OR AILERONS BY A SIMPLE MOVEMENT OF THE WINGS



WHEN THE FUSELAGE IS LONG OR WINGS STEEPLY SWEEPED, AS THEY HAVE TO BE FOR SUPERSONIC FLIGHT, A PROBLEM IS CREATED AT TAKEOFF AND LANDING: THE UNDERCARRIAGE LEGS WOULD HAVE TO BE IMPOSSIBLY LONG TO GIVE THE NECESSARY GROUND CLEARANCE



DR. WALLIS' "SWALLOW" CONCEPT WITH THE WINGS IN POSITION FOR TAKEOFF OR LANDING



THE CONTROL DECK RAISED FOR LANDING

THE NOSE IS "DIPPED" IN DESIGN TO GIVE THE PILOT A BETTER VIEW FORWARD WHEN LANDING

THE PIVOT AND TURN MOUNTING OF THE ENGINE NACELLES PRODUCES THE NEEDED FLIGHT CONTROL

Movable-Wing Plane

MAN'S ATTEMPTS TO FLY like birds—by flapping his arms or some winglike contrivance—usually end in disaster. A variation on that ancient approach, however, may solve some problems involved in supersonic flight and help man to swoosh through the air at a feather-singeing speed of 1800 miles an hour.

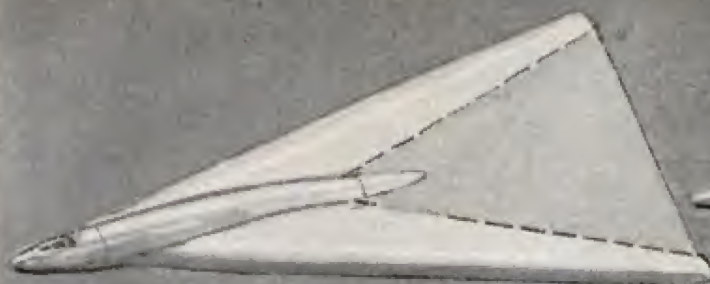
Dr. Barnes Wallis, English airship in-

ventor and chief development scientist at Vickers-Armstrong, has designed a movable-wing plane—appropriately called the "Swallow"—that is thought capable of such speeds. Wings move forward and backward, rather than up and down, to give it high performance capabilities at both supersonic and landing-takeoff speeds.

(Continued to page 251)

POPULAR MECHANICS

IT IS KNOWN THAT WITH DELTA-WING AIRCRAFT, THE HIGH LIFT IS PRODUCED NEAR THE FORWARD EDGES OF THE WINGS. THE CENTER PORTION, HOWEVER, HAS POOR LIFT AND PRODUCES CONSIDERABLE DRAG



CENTER PORTION
HAVING POOR LIFT
AND CONSIDERABLE DRAG



CENTER PORTION
REMOVED

EXPERIMENTS PROVED THAT THIS TYPE OF WING CONFIGURATION HAD AN EXCELLENT LIFT/DRAG RATIO FOR SUPERSONIC SPEEDS

AN EARLY DESIGN BY DR. BARNES WALLIS OF A MOVING-WING, VARIABLE-GEOMETRY AIRCRAFT

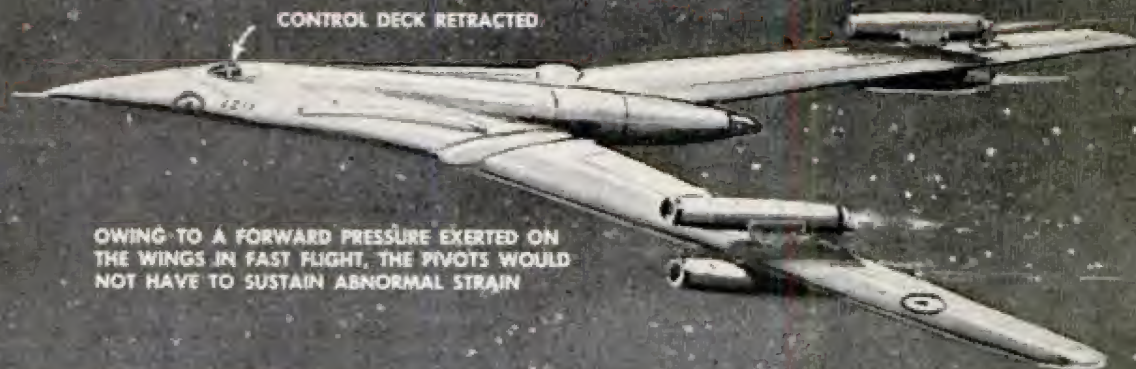


PLAN OF WINGS IN POSITION
FOR TAKEOFF AND LANDING



PLAN OF WINGS IN POSITION
FOR SUPERSONIC FLIGHT

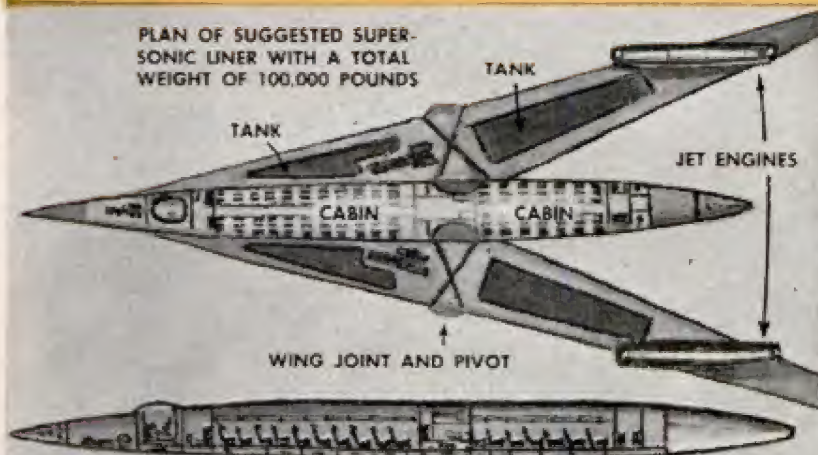
THE WINGS IN POSITION FOR SUPERSONIC FLIGHT



CONTROL DECK RETRACTED

OWING TO A FORWARD PRESSURE EXERTED ON THE WINGS IN FAST FLIGHT, THE PIVOTS WOULD NOT HAVE TO SUSTAIN ABNORMAL STRAIN

PLAN OF SUGGESTED SUPER-SONIC LINER WITH A TOTAL WEIGHT OF 100,000 POUNDS



WING JOINT AND PIVOT

SIDE VIEW OF SUGGESTED LINER ON THE "SWALLOW" PLAN FOR SOME 60 REAR-FACING PASSENGERS

THIS IS A PHOTOGRAPH OF A MODEL OF THE "SWALLOW" SHOWING THE WINGS IN VARIOUS POSITIONS DURING ALTERING ASPECTS FOR TAKEOFF AND LANDING, AND SUPERSONIC FLIGHT





DETROIT LISTENING POST



By Jim Whipple



Every-other-year lubrication? Lifetime mufflers?

LIKE PEAS in a pod. That's what the word was in the world of half truths, rumors and educated guesses concerning the **Buick, Olds and Pontiac** compacts. But how wrong can we prognosticators get? The **B.O.P.** compacts share pods all right—nearly identical unit bodies by **GM's Fisher Division**—but inside these sleek shells divisional engineering staffs have gone their separate ways with a vengeance.

OLDS F-85 and **Buick Special** share suspensions, drivelines and manual transmissions. Their V-8 engines are considerably different, although based on a common aluminum block. Automatic transmissions follow different paths entirely.

Pontiac's Tempest—a name well-chosen—is the only one of the three with independent rear suspension "transaxle," contrary to a false lead published in this column last month. **Buick Special** and **Olds F-85** have conventional, "solid" rear axles.

AN ILLUSTRATION of how such stories start; some sources held that the **Tempest** would have torsion-bar suspension a la **Chrysler**. This assumption was based on fact too, **Pontiac** was ordering torsion bars in pairs from a supplier. **Pontiac** engineers are enjoying a laugh on this one however—the bars are used as driveshafts!

The **Tempest** does have the startling, 45° slant four-cylinder engine however, the first four to appear on a **GM** car since 1928.

For those who want it, the syrupy smooth, more powerful aluminum V-8 will also be available in the **Tempest**.

THESE THREE new compacts should make a profound impression on the 1961 market. They represent the second phase of the compact car revolution—that of the designed-for-the-job, medium-priced compacts. (The third and final phase will be Detroit's invasion of the small economy market with a \$1600, four-passenger car.)

The **F-85**, **Tempest** and **Special** provide all the traditional virtues of the typical medium-priced big car; smoothness, excellent ride, low noise level, powerful performance and good workmanship. What's more they're practical, six-passenger cars with center-of-seat comfort.

HOWEVER, these new **B.O.P.** cars are expected to throw a wicked curve at the harassed ranks of the "low-priced-three," (**Chevy, Plymouth, Ford**, and newcomer **Dodge Dart**). Some of these are already bleeding from wounds inflicted by the "economy five" (**Falcon, Rambler, Corvair, Valiant** and **Lark**) in the 1960 sales battle.

Just how rough things will get for some of the old timers in the low and medium-price fields remains to be seen. A lot depends on the **B.O.P.** compacts' prices too. Most educated guesses peg them at \$2400 to \$2700 with the four-cylinder version of the **Pontiac Tempest** base-priced at close to \$2000.

IF THIS LAST price holds true it will be the result of a shrewd marketing move by **Pontiac** boss **S. E. Knudsen** to put his new **Tempest**, with its larger (112-inch wheel-base) body, into competition with smaller compacts such as **Falcon, Rambler** and **Corvair**. The expectation of lower price for the **Tempest** would be a natural result of engine economies. The cast-iron **Pontiac** four is machined right on the big-engine line—it is actually the "starboard" bank of the 389-cubic-inch V-8, and so is considerably cheaper to tool and produce than the all-new aluminum V-8.

PERHAPS equally interesting as the '61 cars themselves are some of their features designed to keep owners happy long after that new-car thrill has gone.

For example, all **Rambler**s will be coming off the line with ceramic coated exhaust systems. This is the lifetime muffler for real—'61 **American Motors** tail pipes and mufflers will be as rustproof as a china cup. This should become an industry-wide trend and put the million-dollar muffler replacement business in the same class as miniature golf courses.

AN END to incessant—and inconvenient grease jobs will be the result of a lubrication breakthrough at **Ford Motor Company**. Owners of '61 **Fords, Mercurys** and **Lincoln Continentals** will probably need take their car in for a lube job once every other year unless they drive more than the 10,000-mile-a-year national average. ★ ★ ★



Collapsible Fire Escape Folds Up Inside Window

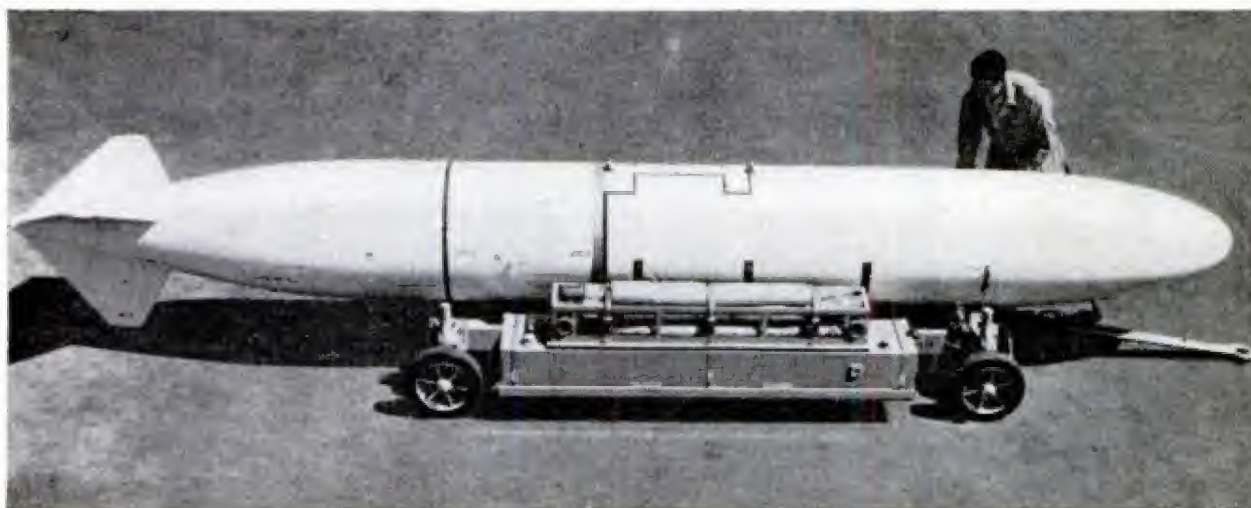
So compact it fits into a small metal box that extends just six inches from the wall, and so easy to use that an 11-year-old boy can operate it, a collapsible fire ladder is strong enough to allow a teacher and 30 pupils to evacuate a room in three minutes. Bolted under the window sill, the platform is swung over the sill, allowing the chain ladder, folded up inside, to drop freely to the ground where it is anchored.



"Peaceful Torpedo" Produces Emergency Power for Navy Jets

Resembling a torpedo, but containing a power package instead of explosives, a 26-foot-long pod provides emergency ground support for Navy jets. Driven by a gas-turbine engine, the power unit produces electricity for ground instrument check-out, refrigeration for cooling both the aircraft electronic compartments and the pilot's suit, and air for engine starting. The advantage of placing this equipment inside

a compact torpedo-shaped pod is that the pod can be strapped to the jet, just like a torpedo, and flown to advance bases where similar equipment is unavailable. Ordinarily such equipment is brought in by cargo ship or truck. Inside the compact pod it can be flown from base to base at will. Since such equipment is necessary only prior to takeoff, none of it is built into the jets, leaving them as light-weight as possible.



THIS BUSINESS

***A former OSS agent and foreign-affairs expert
tells how both kinds of intelligence
—open and secret—are collected,
evaluated and put to use***

Kindly innkeeper and his frau gave a last glass of beer on the house to outward-bound German sub crews, waved them on their way and scuttled to a radioman who flashed word to the British Admiralty



OF SPYING

By
Richard
Dunlop

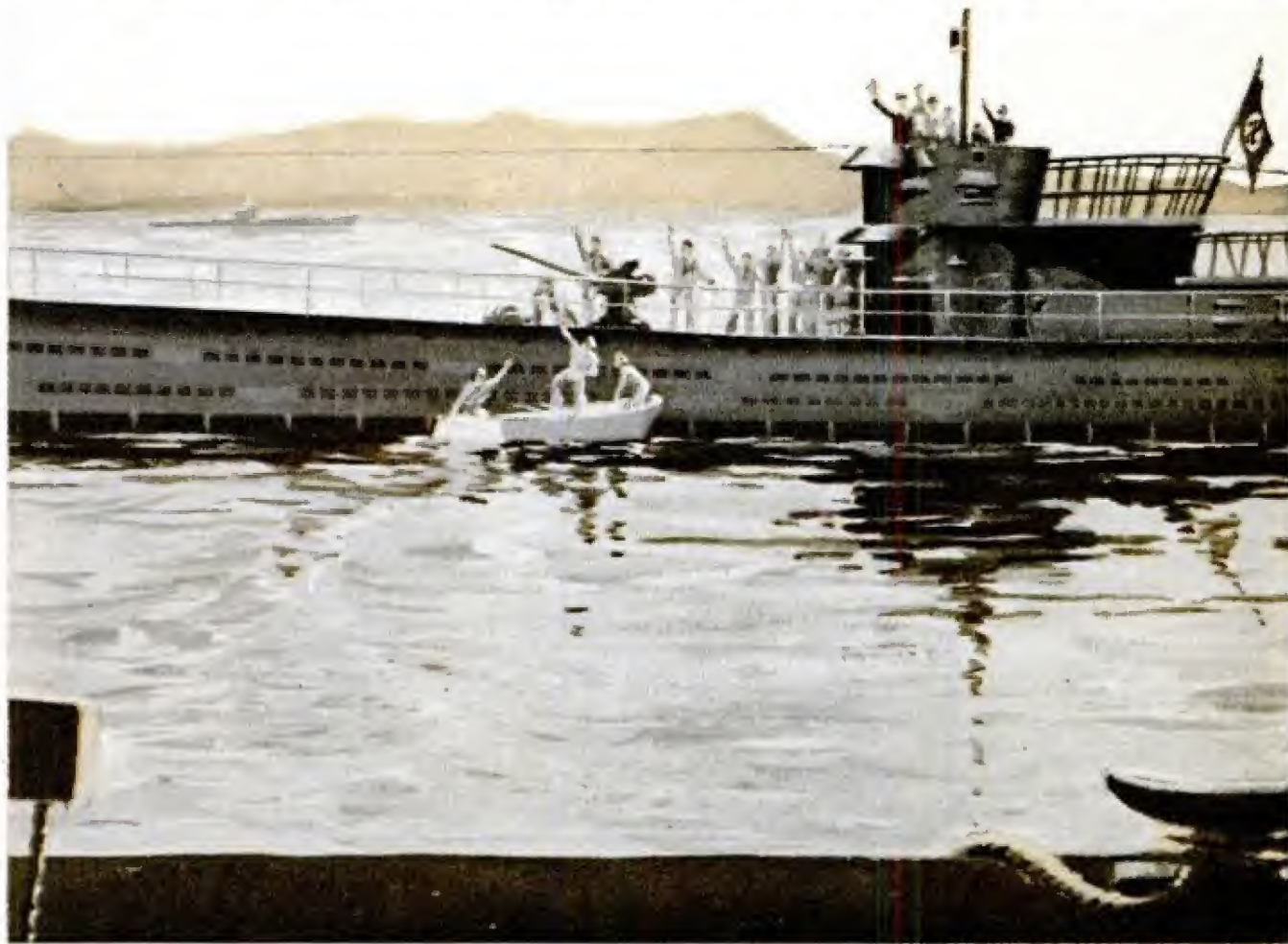
LATELY it has almost seemed that Alfred Hitchcock has taken to writing newspaper stories. Relentless Israeli agents climax a 15-year search for a hated Gestapo official, Adolf Eichmann, by kidnapping him from his Argentine hiding place. A high-flying United States U-2 weather plane is downed in the Soviet Union, and its pilot admits he is an American spy taking reconnaissance pictures with a secret high-altitude camera. The American representative to the United Nations reveals that the handsome great seal of the United States, a gift from the Reds which had hung over the desk of the American ambassador to Russia at the embassy in Moscow, had a listening device and antenna concealed in it. President Eisenhower sets out on a good-will trip to the Orient, but professional agitators in the pay of the Communists stir up such violent anti-American riots in Tokio that Japan's government has to tell him not to come for fear it cannot protect his life.

In an easy-going world of suburban back-yard barbecues and Sunday after-

noon ball games it all sounds incredible. One day a neighbor said to me, "You were in OSS. Is all of this agent stuff for real?" I regretfully had to assure him it most certainly was for real and that, in fact, the United States is the world's fattest target for foreign spies and agents.

When an intense ideological and political conflict reaches a stalemate as has the cold war, then the cloak and dagger war of subversion takes on greater activity and meaning. In all countries, winning diplomacy and national strategy must depend upon how effectively intelligence concerning other nations' capabilities and intentions is collected. This means that today shadow armies of secret agents are contending for the future of mankind.

The late Maj. Gen. William J. Donovan, director of the Office of Strategic Services (OSS), America's first effective intelligence organization, told me once that in a democracy the public must support an intelligence effort if it is to be successful. He pointed out that the FBI, which is responsible for counter-intelligence in the United





Richard Dunlop, foreign affairs expert and prize-winning author, served as an agent with the Office of Strategic Services in Burma and China during World War II. Guerrilla warfare and intelligence experience in the crack OSS Detachment 101 in Burma and assignments in China gave him inside knowledge into Asiatic affairs, which led to a post-war career in foreign trade as president of Richard B. Dunlop, Inc. He was chairman of the American-Kachin War Memorial Committee which was formed by the late Maj. Gen. William J. Donovan, director of OSS, to repay America's debt of gratitude to the Kachin people of Burma's hills who had aided the Allied cause. Dunlop later withdrew his firm from Asia because of Red turmoil. He has since acted as a foreign affairs consultant while at the same time becoming a nationally known writer of stories and articles. He has made contributions to leading magazines, including *POPULAR MECHANICS*, and is author of "Burma," "St. Louis" and "The Young David." He shared the Spur Award for the best western nonfiction of 1958 for "Saddlebag Docs" in the collection, "This Is the West."

States, has long understood the value of public support, but that the OSS's successor, the Central Intelligence Agency, balks at taking the public into its confidence even when security would permit it.

I have never been a spy nor do I have any intention of being one. But my work in OSS and a continuing private interest in foreign problems since World War II have made me familiar with the way in which an intelligence apparatus works. I think that the public should be told as much as possible about the vital business upon which so much depends.

First thing to keep in mind is that at least 90 percent of intelligence is gathered in an above-board manner. Even the Bible can be a source of intelligence. In February, 1918, a British force was moving on Jericho which was in the hands of the Turks. It was first necessary to take Michmash village, which governed the approaches. Since the point was on a high hill and heavily fortified, there seemed nothing to do but storm it. But the name, Michmash, sounded familiar to a young officer. That night he thumbed through his Bible until he came to I Samuel, Chapters 13 and 14.

There he read how the Israelites had surprised the Philistines at Michmash, making use of a hidden pass. The Bible went on to describe just how to find the pass. The officer, using this ages-old intelligence report, led his unit through the pass and, striking the Turks by surprise, defeated them.

This was an exceptional case. For the most part, open intelligence is gathered by specialists who sit at desks in Washington, London or Moscow and study newspapers, books, scientific journals, official publications, yearbooks and corporation annual reports. This copy of *Popular Mechanics* will be read in every major intelligence bureau in the world. When travelers return from abroad, many countries "debrief" them of any information which they may have learned. The United States rarely does this, but Communist countries almost always do. Experts also monitor radio and television broadcasts.

Most of the information gathered in this unsensational way is of economic, social, political, technical and scientific or cultural nature. Rarely are military plans leaked in the public press. Still, amazing things can be learned from open sources. Experts at

Opposite page: Swiss waiter helps German agent carry "drunken" friend from restaurant to waiting car. His helpless victim at his side, the agent drove through border guards to the waiting Gestapo in Berlin

Henry Cabot Lodge (below), U.S. representative to the U.N., displays the great seal of the U.S. which hung over the desk of the American ambassador to Russia. In it the Reds had hidden a transmitter and antenna







Soviet trawler Vega loaded with radar, was caught red-handed spying on Polaris missile tests off Long Island, and photographed by a Navy airship. The Reds are often caught "fishing in troubled waters"

reading between the lines get a lot more out of an ordinary newspaper report than does the commuter on a home-bound train. This was brought home to Adolph Hitler one day in 1935 in a way which caused him to bite his knuckles with rage.

Berthold Jacob was a German journalist who fled the Reich when the Nazis seized power. He edited an anti-Nazi newspaper in Strasbourg, France, and taunted the Führer. One day he published a book giving the complete organization of Hitler's illegal new army. That is when Hitler exploded. He demanded that his spymaster, Col. Walther Nicolai, find out who was responsible for such damaging leak of top-

secret information. Nicolai in turn assigned the case to agent Hans Wesemann.

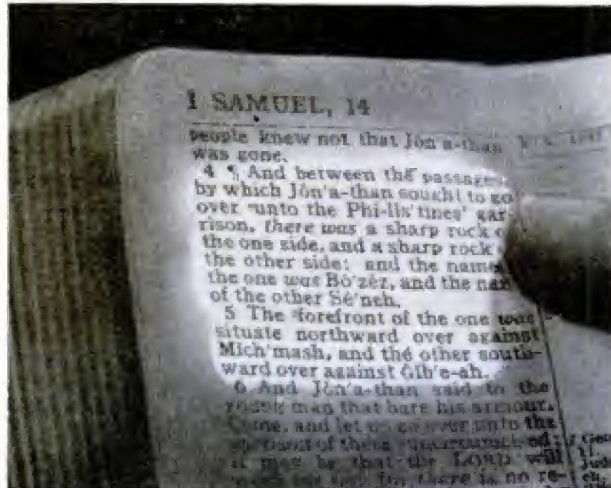
Wesemann found a favorite Red or Fascist solution to the problem. He lured Jacob to Basel, Switzerland, by posing as a literary agent. The two men dined in a fancy restaurant in the heart of the city as the seeming literary agent promised great things to the aspiring newspaperman. When Jacob excused himself to go to the men's room, Wesemann slipped knockout drops in his drink. Jacob sipped his glass and slumped into helplessness.

"I apologize for my friend," Wesemann said to the Swiss waiter. He persuaded the man to help carry the apparently drunken

Spies have trouble hiding their monitoring schedules. Russian agent Abel hid his in this hollow pencil



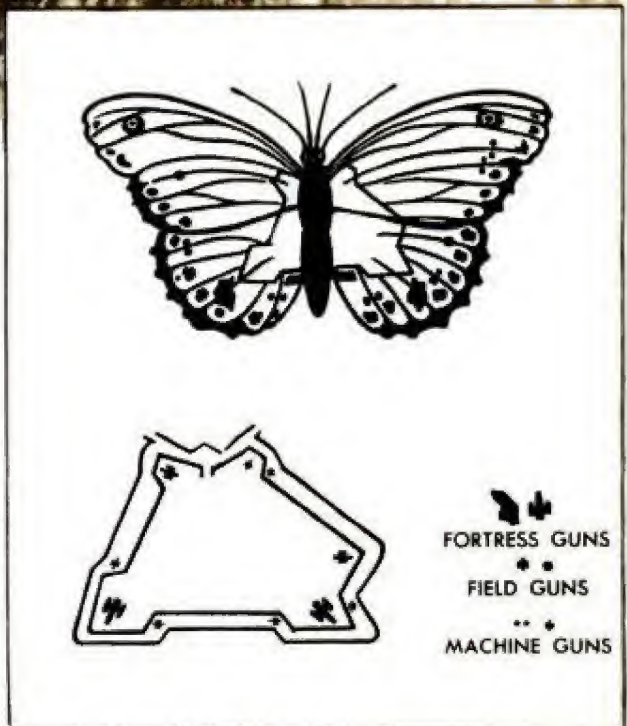
British major won a battle in the Middle East with the aid of intelligence learned from the Holy Bible





Jacob to a waiting car. Then he drove furiously through the Swiss border guards into Germany.

Jacob regained consciousness to find the cold eyes of Walther Nicolai looking into his own. He was at Gestapo headquarters in Berlin. How had he discovered the German Army's secrets? It was not hard. Jacob talked freely. He had read accounts of funerals and weddings which appeared in newspapers throughout the Reich. Whenever an army officer present had been identified by name, rank and unit, he had jotted the information down. In this way, he had been able to piece together the composition of the entire German army. An amateur had beaten the sharpest intelligence officers at their own game of assembling scraps of information to arrive at the complete picture. Nicolai could not help but admire Jacob's skill and graciously returned him



Posing as an entomologist, Baden-Powell drew vital details of an Austrian fort in a butterfly sketch

Zionist spies bugged this book with a transmitter and listened in on the Egyptians by remote control



FBI cryptanalyst shows how alphabet strips are slid in an effort to decode a spy's secret message



Newsboy James Bozart holds up a nickel which split in half and betrayed Soviet spy Rudolph Abel. The boy received the nickel from two women customers. When it broke apart in his hands and revealed some microfilm, he gave it to a policeman who turned it over to the FBI. The clue led to the spy's arrest

safely to Switzerland, creating an international furor when Switzerland and France learned how he had been abducted in violation of their sovereignty.

In a real way Berthold Jacob had acted as a one-man intelligence apparatus. As do all intelligence organizations, he had collected information, appraised it, pieced it together and disseminated it to those who needed it, in this case, the people of western Europe whom he wished to alert against the Nazi menace.

It is probable that the Russian intelligence numbers at least 15,000 men and that our own CIA has perhaps 12,000 employees. Only a small fraction of these people are intelligence officers and fewer still are spies, but together they have as their primary task the same sort of job as Jacob set for himself.

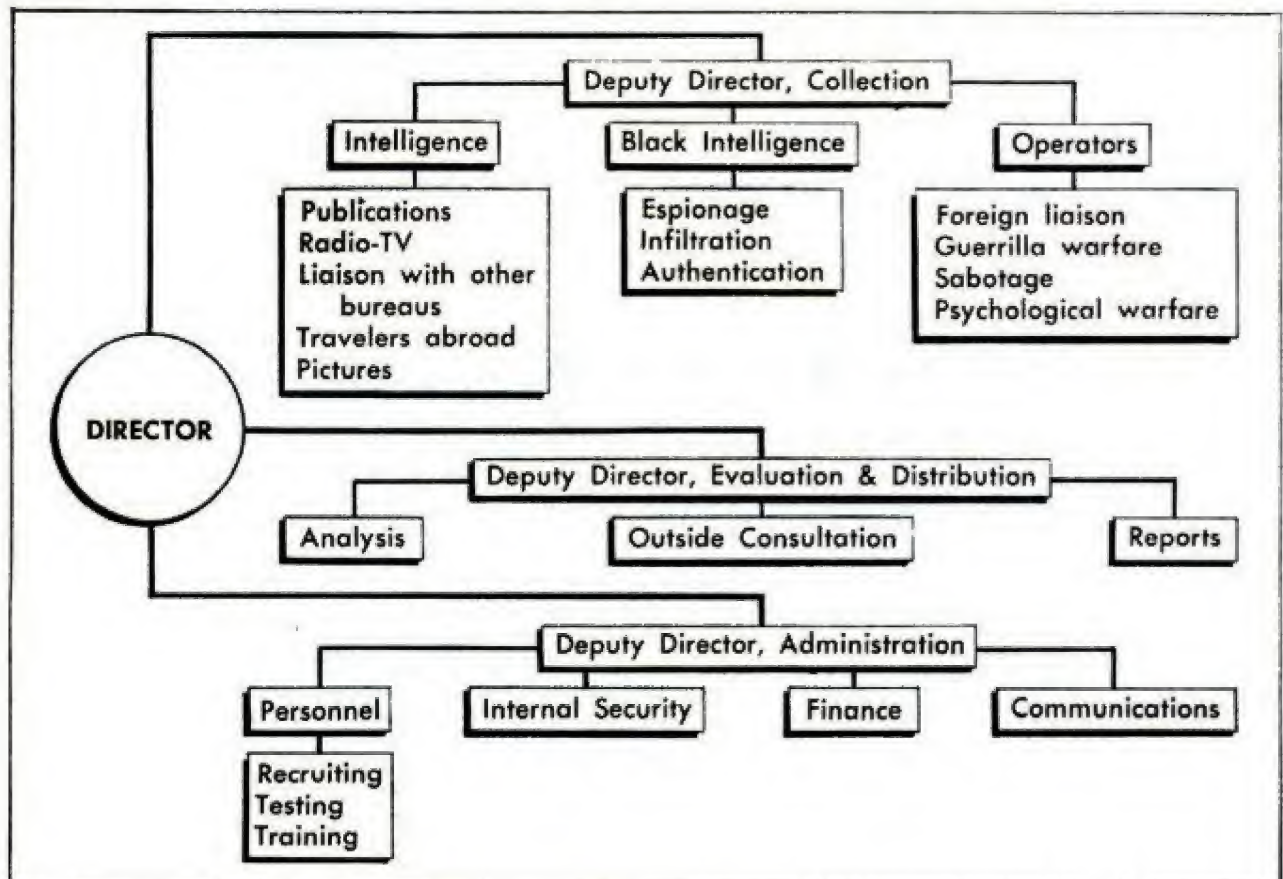
To take the mystery out of this process

let's reconstruct the way in which Red agents reported the atomic bomb to the Kremlin. Of course, while Jacob was dealing in open intelligence, the Reds were trafficking in secret intelligence. In other words, they were spying.

On March 28, 1945, a Soviet agent in Ottawa, Ont., lunched with a young scientist named Durnford Smith, who had long been informing on American, British and Canadian research. The agent, who had been instructed to learn all he could about radar development, kept pressing Smith for more information. Smith heatedly told him that radar just was not important anymore. The main thing now was that the three allies were making a frightful bomb using atomic energy. The agent reported this information to Colonel Zabutin, the top Soviet spy in Canada. Zabutin graded

(Continued to page 230)

Typical agency has three divisions for collecting information, evaluating it, and managing the business

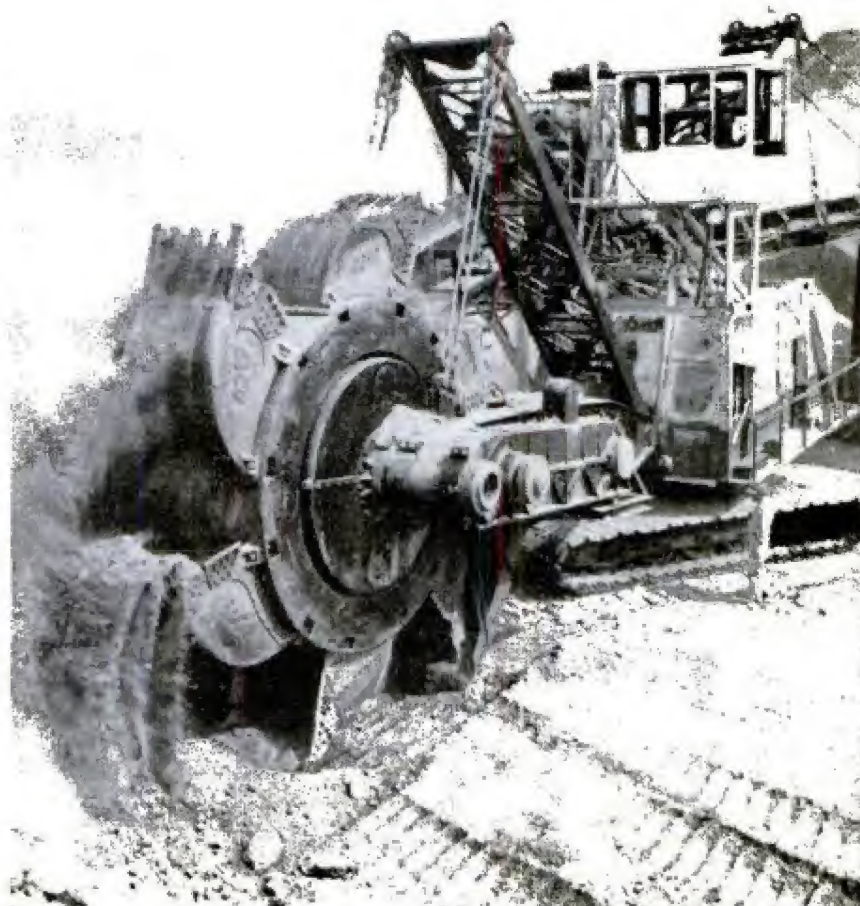




NOW IT'S THE drive-in vacuum cleaner! Resembling a gas pump, a coin-operated British machine is installed at service stations to allow motorists to clean car interiors, seats and ashtrays when they stop for gas. The outdoor vacuum cleaner operates for three minutes for sixpence (about seven cents), with the expired time registering on a large dial. The upper part of the unit contains the electric suction equipment, plus the coin slot and timing mechanisms. Refuse container is located at bottom of machine

"Wheel" Digger Gobbles Big Bites

Digging, screening and delivering 14 million tons of earth fill for Abiquiu Dam in New Mexico seemed like a heroic task for at least four big five-yard power shovels until contractor Bill Mittry and engineer Carl Wilms designed a huge wheel excavator. It wades into the ground with six 1½-yard buckets turning at 10 revolutions per minute on a 21-foot wheel, with the wheel turning in a 180-degree arc at the same time. Gobbling up 3500 tons of earth per hour, the wheel throws it over its shoulder onto a four-foot continuous belt which carries the earth 54 feet to a 30-yard mobile storage bin following behind. From there the fill is trucked to a 4300-foot overland belt system.



U.S. Rubber Co. photo

OWNERS
REPORT

A NATIONWIDE SURVEY

BASED ON 2,494,808
OWNER-DRIVEN MILES

LOVE THE LOOKS, RIDE AND

MARGINAL COMMENTS
BY JIM WHIPPLE
PM's AUTO EDITOR

This job was the original "bachelor's bomb," an ideal vehicle for luring → delicious damsels off the sorority house front porch.

The 'Bird represented the return of something like the Cord, Packard → boat-tail speedster or Stutz Bearcat, cars that these people had coveted in their youth, but could not afford.

IT'S HARD to remember a single car that's made the impact on public imagination that Ford's Thunderbird has in the past two-and-a-half years. The big 'Bird stormed the rarefied atmosphere of the luxury field like Marilyn Monroe crashing a society tea.

It all started rather quietly when Ford brought out the first two-passenger T-Bird back in 1955. It was billed as a "personal car" intended as a hedge against the encroachment of imported sports cars.

To the surprise of most of the auto industry's crystal gazers—the world's most fallible prophets—the '55 and '56 T-Birds appealed to more than just the young sports looking for a sort of Corvette with creature comforts.

Highly proper, middle-aged doctors and bankers—and their wives—began to appear on the highways happily crouched in Thunderbirds. Along with this new and somewhat unexpected buyer group came a strong groundswell at the dealer level in the shape of demand for a T-Bird with greater passenger and luggage capacity. Ford heeded the call and the rest is history. The current four-passenger, bucket-seat 'Bird, introduced in the fall of 1957, has been a virtual sellout everywhere ever since.

Now, let's take a look at a wide sampling of 1960 T-Bird owners who answered PM's questionnaire, find the reasons

HOW GOOD IS THE THUNDERBIRD?

Owners like:

Styling55.4%
Handling ease49.2%
Riding comfort36.1%

Power, performance31.4%
Roadability, cornering16.9%
Comfortable seats12.6%



POWER, SAY THUNDERBIRD OWNERS

why they bought the car, what they like about it and how well they are satisfied with their choice.

A healthy 76.5% of owners reporting consider their Thunderbirds Excellent. A minority of 18% say that their joy of ownership has been marred by minor flaws and repair problems. At the bottom of the pile, and really unhappy are 5.3% who rate their cars poor.

Styling is really the big attraction with 55.4% mentioning it as a "best-liked feature." Next comes handling ease with 49.2% of owners reporting, and riding comfort follows with a 36.1% mention.

Here's what the owners actually said in their reports. The following quotations describe the five best-liked features in order of frequency of mention.

"Acquiring my Thunderbird—the best-looking car on the market—gave me as big a thrill as when I bought my first car back in 1933."—Missouri librarian.

"This is the best-looking car on the road."—Texas store owner.

"Styling, and not changing that styling is the principal reason that I bought a T-Bird. If they change that styling, they lose me!"—Minnesota art director.

"I've always liked the T-Bird's looks since it first came out, a real beauty of a car."—Illinois typist.

Part of the magic too, is that the T-Bird is so different in appearance. Its styling represents a welcome change of pace from long cars with high fins.

Owners like this man are on to a good thing—a car that grows old gracefully rather than rapidly obsolete. A well-kept '58 T-Bird looks just as "new" as a '60; a state of affairs too good to last.

WHAT'S WRONG WITH IT?

Owners dislike:

Hard to get in and out....28.9%
 Engine trouble11.2%
 Poor gas mileage..... 8.5%

Bad workmanship 7.4%
 Brakes 4.9%
 Transmission troubles..... 4.6%



Rear seats are fairly roomy, quite comfortable once you get in. Three might squeeze in except for tunnel



Here's T-Bird owners' biggest gripe, the difficulty in getting in or out. Seat's all the way back

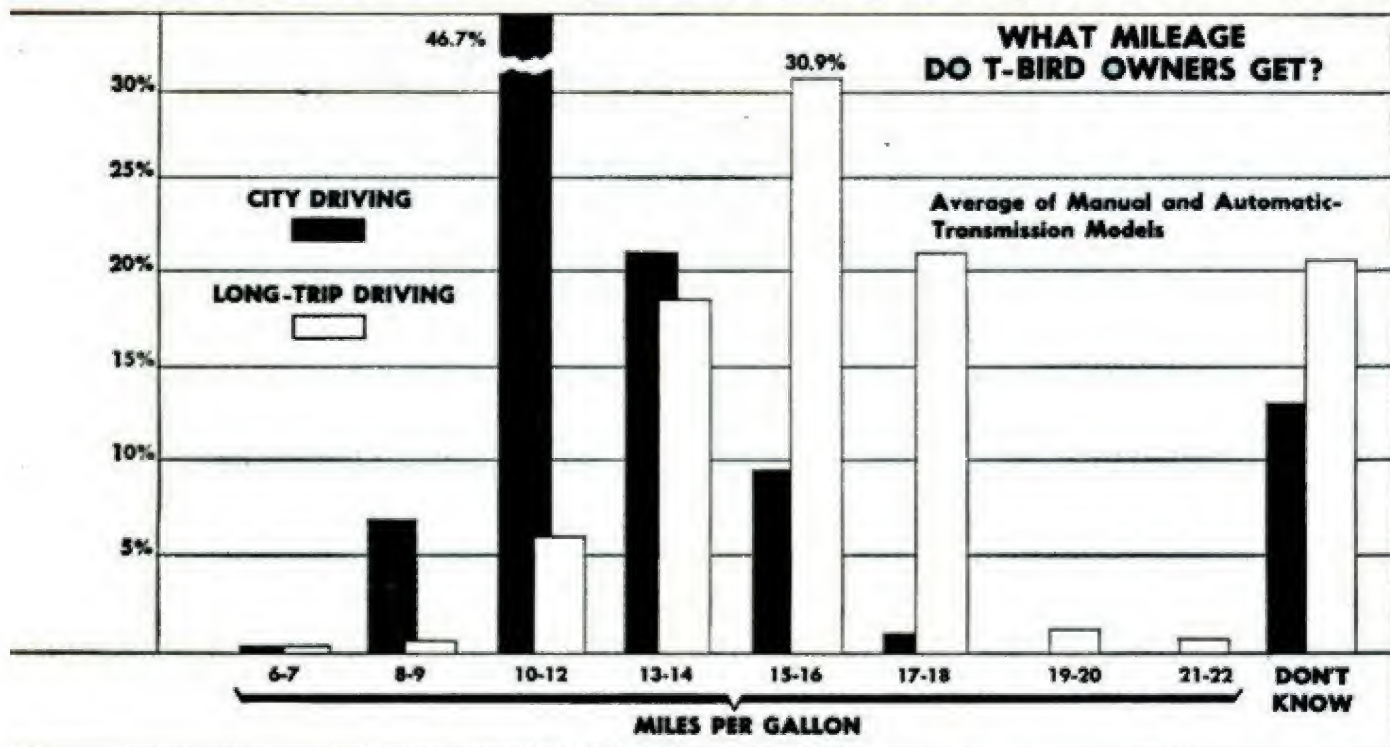


Space to waste up under hood—a full eight inches lies between rear of engine and the firewall—who needs it?



The rear-seat passengers, that's who! If firewall moved up, rear legroom could be doubled

Graph shows that most 'Bird owners get 10 to 12 miles per gallon in city, 15-16 in cross-country driving





Tunnel dividing front compartment is a source of annoyance when you must cross through car



Trunk is shallow but makes good use of space provided. It's easy to load, and adequate for small family

"It's conservative, genuine leather upholstery is striking."
—Montana merchant.

"Tell Ford not to change the styling or size. This one is too good to be true."—New York lawyer.

"It has big-car ride and comfort, but handles like a compact car in traffic."—Tennessee cement plant manager.

"This is the finest and most-fun car I've ever owned—a joy to drive."—Indiana housewife.

"I like the way the car handles, but so does my wife, therefore I seldom get a chance to drive it!"—Utah refinery superintendent.

"Driving this car is tireless."—Michigan architectural consultant.

"Effortless town and road driving, fun to drive."—Virginia traveling salesman.

"It is so easy to handle it almost seems to drive itself."—Michigan clerk.

"Excellent ride and handling, I drive around 60,000 miles a year."—California salesman.

"It is the easiest car to drive on a trip or in town that I've ever driven."—Florida carpenter.

"I drove 700 miles without stopping except for gas and food and was in good shape at the end of the trip."—Indiana baker.

"Rides like heavier cars that I've had in the past yet handles easier."—Pennsylvania broker.

"Bucket seat is wonderfully comfortable, the car itself handles well and I've covered over 1200 miles in 24 hours without being exhausted."—Oklahoma jet pilot.

"Bird has the needed reserve power for safety in passing."—Wisconsin financier.

"The T-Bird just sits down and goes without burning any rubber off the tires."—Michigan instrument man.

"Quick pickup, can walk away from anything without being obvious about it."—Connecticut housewife.

"Has the speed and power when you need it."—Massachusetts sales manager.

"Riding and handling perfect, a really good 'old people's sports car.'"—Massachusetts housewife.

"Holds the road very well; when necessary to run off onto shoulder the car stays under control."—Missouri sales agent.

"Handles like a big car, remarkable on turns at high speed."—Nevada truck driver.

The comfortable, semi-bucket driver's seat, shorter wheelbase and power steering are the prime ingredients in T-Bird's recipe for success in this area.

At close to 4000 lb., the Thunderbird is probably the heaviest car ever built on a modest 113-inch wheelbase.

With the big, 430-cubic-inch engine rated at 350 horsepower, there is a good deal of genuine thunder in the 'Bird. You can reach 60 m.p.h. in less than nine seconds.

Very true. The T-Bird has a nimble, close-to-the-road quality that gives the impression of a sports car without the violent movement and harsh ride of the real thing.



Birds of a feather! Comet, right, shows strong styling kinship to T-Bird, a point to which some owners object

It's next to impossible to make a car as low as T-Bird is with engine in front and conventional rear axle drive. →

On long trips the comfort outweighs the inconvenience, but on short hops around town, entry-exit problems are a valid complaint. →

"High winds do not seem to affect it."—California treasurer.

And Here Are Some Complaints

The following quotations describe in the order of their frequency the five leading complaints.

"When driver must exit from right because of parallel parking it makes for a very awkward situation climbing over center tunnel, especially for a woman."—California auditor.

"Difficulty in getting into car on account of 'knee-knocker' windshield corner."—Florida engineer.

"Ingress and egress most awkward, but car is most comfortable once you're inside."—California druggist.

"Children bump their heads getting into it."—Montana housewife.

"Impossible to get in and out comfortably, I'm 5'10" tall and weigh 160—so it's not me that's at fault."—New York surgeon.

(Continued to page 242)

SUMMARY OF OWNERS REPORT: T-BIRD

Excellent 76.5%

Poor
Average 18.2% 5.3%



Thunderbird is only car in family?
Yes, it is... 37.4%
No, it is not... 62.6%

Make of other cars
Thunderbird... 2.1%
Ford... 18.9%
Other Ford makes... 8.2%
Cadillac... 6.8%
Chevrolet... 6.8%
Other GM makes... 14.0%
Chrysler Corp. make... 7.1%
Other U.S. ... 2.5%
Foreign cars... 5.7%
Unspecified... 1.1%

Satisfied gasoline economy?
Yes, satisfied... 69.6%
No, not satisfied... 30.4%

Best-liked features
Styling... 55.4%
Handling ease... 49.2%
Riding comfort... 36.1%
Power, performance... 31.4%
Roadability, cornering... 16.9%
Comfortable seats... 12.6%
Compact size... 12.3%

Most-frequent complaints
None at all... 28.9%
Hard to get in and out... 11.2%
Engine trouble... 10.9%
Poor gas consumption... 8.5%
Bad workmanship... 7.4%
Brakes... 4.9%
Transmission troubles... 4.6%

Had engine trouble?
No trouble... 67.2%
Some trouble... 26.8%
Considerable trouble... 6.0%

What was trouble?
Carburetor... 7.4%
Wiring, ignition trouble... 6.0%
Poor idling, missing... 3.3%
Hard starting... 3.3%

Best-liked interior features
Seats... 46.4%
Instrument panel... 10.9%
Upholstery... 10.4%

Least-liked interior features
Transmission hump... 12.6%
Divided seats... 5.5%
Difficult entry or exit... 4.1%

Did you consider a foreign car?
Yes... 12.8%
No, did not... 87.2%

What make?
Mercedes... 21%
Jaguar... 11%
Triumph... 3%

Did you consider another U.S. car?
Did... 38.8%
Did not... 58.5%
No answer... 2.7%

What make?
Ford... 5.5%
Other Ford products... 5.5%

Cadillac... 7.4%
Corvette... 2.1%
Chevrolet... 1.9%
Other GM make... 13.7%
Chrysler Corp. ... 3.0%

Foreign car ownership
Never owned a foreign car... 78.4%
Previously owned one... 10.7%
Now own one... 4.4%
No answer... 6.5%

Best-liked exterior features
Low distinctive lines... 33.6%
Minimum of chrome trim... 4.9%
Roof line... 4.6%

Least-liked exterior features
Taillights... 5.7%
Grille... 5.2%
Rear fender trim... 3.0%

How is dealer service?
Excellent... 45.6%
Average... 39.7%
Poor... 14.7%

Would you buy from him again?
Yes, would buy again... 57.3%
No, would not... 13.7%
No answer, don't know... 29.0%

Next car will be
Another Thunderbird... 56.0%
Other Ford make... 2.2%
General Motors make... 2.7%
Chrysler Corp. make... 1.1%
Foreign car... 2.7%
Undecided... 35.3%

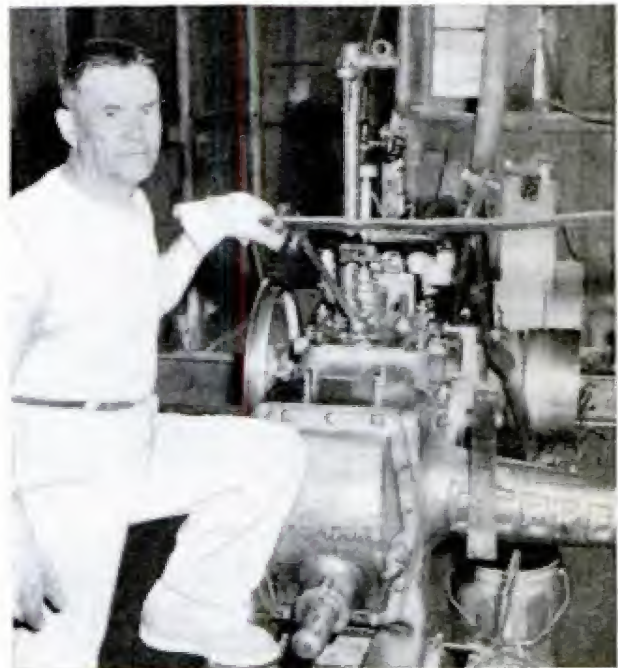


Tractor Engine Powers Ferry

Eighteen hours a day, seven days a week, a ferry powered by a tractor engine "furrows" its way across the Wabash River transporting passengers and automobiles between docks in Indiana and St. Francisville, Ill.

The ferry has been operated by a family named Caldwell since 1920, but it was not until 1941 that Ike Caldwell hit upon the idea of using a farm tractor as the rugged power source his almost continuous operation called for. A tractor, devoid of wheels, was moved into the boathouse. Plates were welded to axle ends and bolted to shafts carrying the eight-foot paddle wheels.

"We grind the valves and replace the rings each 18,000 hours of service," Caldwell says. "It costs about \$7.00 a day to run. That's why we can ferry cars for 35 cents a trip and still show a profit."



Prerecorded Tape Cartridge Player

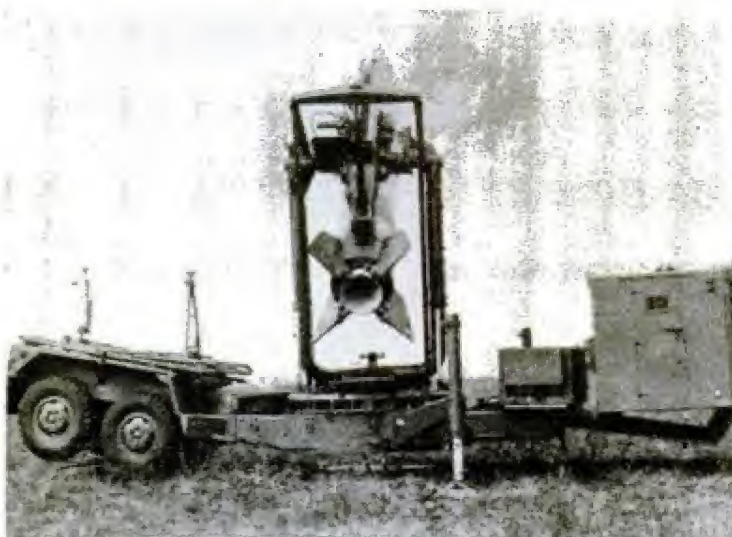
Prerecorded tape cartridges are played automatically on a new cartridge-playing mechanism. A wide variety of prerecorded tapes are available, and the small size makes easy storage possible. After choosing any of the selections available, the desired recordings are simply stacked on the playing mechanism and the unit turned on. The tapes are played one at a time, in sequence. There is no problem involving the threading of tape, as encountered in the reel-type tape recording devices. The tape moves at $1\frac{1}{8}$ inches per second; each cartridge providing one hour of listening.





Mobile Missile System

Transportable by airplane, the U.S. Army's Sergeant missile system makes wide use of a new steel alloy which pares pounds from its launching and trailer rigs. The supporting vehicle that assembles, erects and launches the surface-to-surface missile weighs only 16,000 pounds, some 7000 pounds less than if it had been built with standard-strength steel. U.S. Steel Corporation developed the new alloy for the Army Rocket and Guided Missile Agency which is directing work on the new system.



Doctors Study Skaters

Two University of Michigan doctors are studying spinning ice skaters to learn how they control dizziness when whirling. The results—which so far indicate that skaters somehow suppress impulses rising to the brain from the balancing center in the ear—could offer new avenues of help for people who suffer from motion sickness and certain ear disorders. The experimenters, Drs. Brian F. McCabe and Merle Lawrence, believe their findings may be of help to future astronauts who will encounter, in weightlessness, the disorientation expected in space flight. They photographed skater Ronnie Robertson making 400 r.p.m. without getting dizzy.

We Need Safer Taillights

By Charles Marsh

*Associate Professor of Electrical Engineering
Pennsylvania State University*

**Stylists have confused
decoration with function;
all that glitters is not good.**

IN THE SPEED and confusion of the homeward bound rush, a driver signals with his turn indicator for his turnoff, then touches his brake pedal a few times as he slows down. But the sun shining on his rear spread of chrome dazzles the driver behind him, who doesn't see the feebly flashing signals.

As the first car brakes for the turn, the following car crashes into it. The first car had signaled his intentions clearly, or so he thought, but the severe "whiplash" injury to his neck, as his head was thrown back by the impact, may have paralyzed him for life.

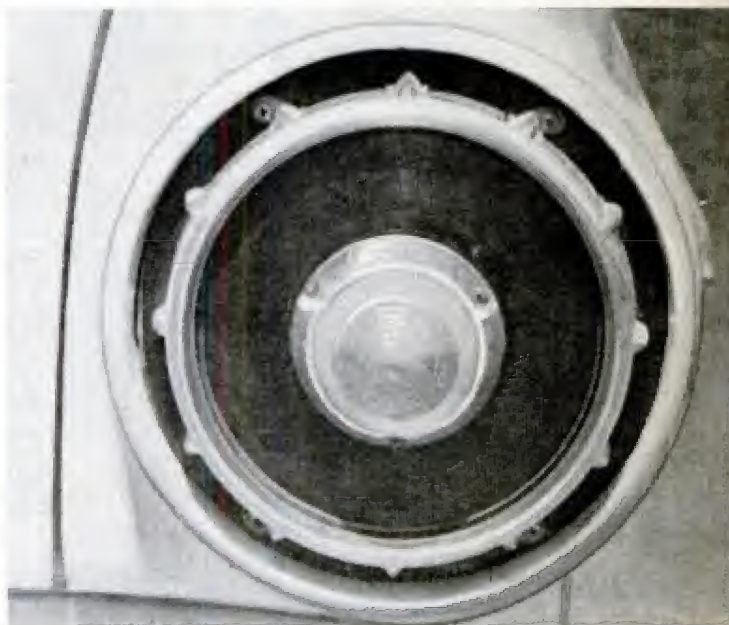
Such rear-end collisions, with their accompanying neck injuries, are occurring more frequently as more and more cars travel on the highways. Not much can be done about the number of cars on the road, but improvements to the stop signals as well as the front and rear turn indicators would help drivers to signal more clearly and thus avoid many accidents.

So that the signal can be seen clearly, the signal lamp should be bright enough for every condition, yet not so bright that it blinds other drivers. It should be located where it can be seen in congested traffic. It should be placed so that mud will not coat it. And it should be separated from dazzling and confusing masses of chromium.

But, most important, the meaning of the signal should be absolutely clear to even the sleepest and most bewildered driver who must make split-second decisions with only half his mind in operation.



The hood or shroud may delight the stylists, but it not only narrows the angle through which the light is seen but causes eddies of air to deposit muddy spray onto the lens much more rapidly (1959 Olds)



Addition of a high reflectance outer ring and backup light at center greatly reduces the daytime effectiveness of this large, low-brightness lamp (1957 Ford)

Here is an example of good lamp placement. The blade-like lense on fin tip can be seen equally well on curves and straights. Air currents flow smoothly around it keeping it free from dirt (1956 Cadillac)





Fin-mounted lights, left, on 1959 Cadillac, look like something from space-age toy, but are effective because they're swept clean by airflow and are visible from all angles. Shrouded, smothered in glaring chrome, taillights on this '58 Buick, center, are very poor. English Ford, right, has clear simple unit combining tail, stop and turn indicator in upper two sections with adequate reflector located separately below

And a drowsy driver can make some pretty strange split-second decisions. For instance, one night the driver of a car carrier found his headlight had failed, so he climbed up and switched on the lights of the front car in his load. Coming over the next hill he met an exhausted, all-night driver who, figuring "If it's that high, it must be that wide," panicked into the ditch.

With the cars on the road today, when a driver sees a red light, assuming he sees it at all, he must ask, "Is it a tail or brake light? Is it bright or not so bright?" If he assumes it is the bright taillight of a new

car, he may find as he jams on his brakes that it is really the dim and dirty taillight of someone stopping on the highway.

If the red light is flashing, his dilemma increases. Is it a turn signal? Or has one brakelight burned out and the driver is pumping his brakes?

If there are two red lights flashing at different rates, what can this mean? One light signals a turn, while the other is the brake light, flashing as the driver slows down. But which way will he turn?

Who would have confidence in marine navigation lights which used bright red

Separate lamps for different functions on this late model Lincoln, below left, are a step in the right direction but horizontal spread in dazzling chrome is poor. Lamps on 1949 Packard, below right, had good separation but were poor because of low intensity lens and confusing integral reflectors





Twin lamps, one for tail and one for stop on this English Triumph, left, with separate reflector are excellent. The triple lights in vertical stack like railroad signals on this 1957 DeSoto above are an ideal arrangement but are surrounded with annoying chrome. Here's a poor setup, right, on '58 Plymouth where a minimum lamp is made worse for daytime driving by surrounding it with bright aluminum trim

lights for port and dimmer red lights for starboard?

So, one fairly obvious improvement would be to use different color lamps for different messages, instead of using only red lamps in the rear. Many European cars use red for their taillights and amber for stop and turn. This is an improvement, but it is really backward. Red should mean stop, and only stop, while amber should mean proceed with caution.

One such system would require an upper red and a lower amber light on each side. Both would be on dim as taillights for night

driving. At a distance, the red and yellow lights would merge to orange, giving some measurement of spacing.

For signaling, both lights would flash, the red light flashing for stopping only, and the amber light for turns. The same flasher would serve both turn and stop lights, so that if the car were both turning and braking at once, while the turn indicator flashed brightly, the brake on the opposite side would drop back to dim. The rate of flashing of a brakelight might even indicate the rate of braking.

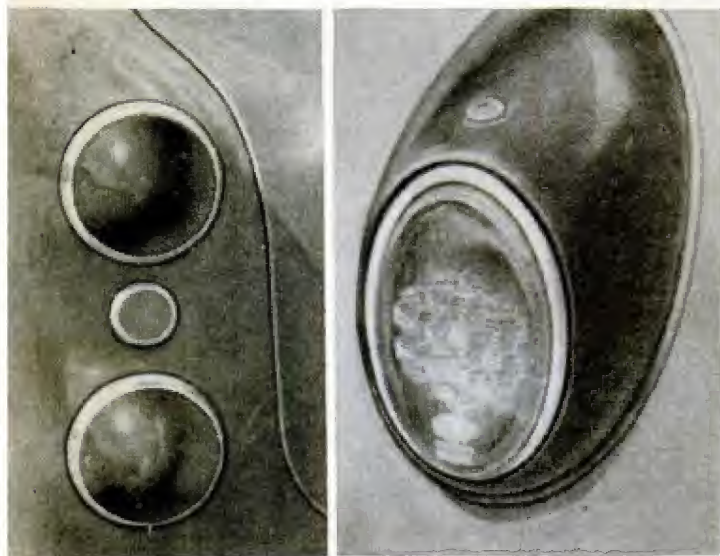
The turn signals in front also need im-

The tail lamp lens on Jeep, below left, is going to get much dirtier from eddy currents of spray than the outboard turn signal. Turn signal grouped with headlamp on this 1957 Plymouth, below right, is very difficult to see clearly when headlamp is on and can be dangerously confusing under certain conditions





A poorly placed turn signal placement on this '57 Mercury. It is so far inboard that it can easily be hidden by a preceding car. It is also too small and viewers are distracted by much glittering chrome



One of the best systems seen in recent years, above left, on '54 Buick. Both are lit for tail lamp, one brightens when brake is applied, other blinks for turn, while reflector is separated. A fine prismatic reflector in exactly the wrong place, above right, on Volkswagen; reflections look like stoplight flashes

Here, on '57 Buick, below, is a nearly ideal signal lamp. It is small to give high brightness, away from chromed surfaces and near outer limit of body



provement. For instance, amber lamps are more noticeable, but most cars still have white turn indicators unless truck fixtures have been installed.

Some turn indicators are so embedded in the grille decorations that they are all but invisible when the sun shines on the chromium. Lights bright enough to outshine all that glitter are too bright for night driving.

If a bright signal is desired in the daytime and a dimmer one at night to avoid glare, it would be a simple matter to connect a switch between the signal and the headlight system.

But, for driving in fog, bright signal and headlights are needed at the same time. In daytime fog the high-beam headlights and the brightest signals are needed to be seen at all.

At night, low-beam headlights are easier to see over in fog, but the brightest signals are still needed, so a special light switch for fog could be used.

In winter especially, road grime can all but obscure rear signal lamps. In some positions turbulence seems to spray dirt onto the lenses, while lamps in other positions are swept relatively clean by the air-stream.

Lamps that are mounted high can both keep themselves cleaner and be seen more readily, either in crowded traffic or on topping a hill in the country. Once upon a time, the tailfins served to hold high-mounted lamps up where they could be seen, but now by some evolutionary process, the lights have slipped down and nestle beneath the fins which create turbulence and suck dirt onto the lenses.

Another design trick to watch for is signal lamps which have reflectors built into their lenses. When lit up by a following car or low sun, these lenses are so bright that the signal may be invisible.

These simple changes, such as using amber turn indicators fore and aft, using red light for stop only, and mounting the lights where they can be seen easily, would give a large margin of safety at very little cost other than intelligent planning.

Yet, even such changes are not easily made, for the massive auto industry and the public to which it sells must be convinced, and in addition the codes of every state must be modified, and this can take several years.

However, changes are under way. Lighting and traffic engineers are studying possible signal systems. Many states are streamlining their equipment-approval procedure. And with today's heavy traffic superior signal systems are essential. Before too long we will find them on our new cars.

★ ★ ★



HUNTER'S MOUNTAIN CAR OUTPERFORMS PACK HORSE

INJURED in an accident that prevented him from climbing or riding horseback into the mountains, an ardent Montana sportsman built a mountain car that covers rough country quicker and carries a bigger load than a horse. Ted Duke's "Centipede" works on the same principle as a tractor. Five wheels are mounted on each side of the machine, the front two coming into play only when the Centipede noses into a large obstruction. The eight rear wheels provide

the pulling power, each operating independently. A bicycle chain drives each one from a sprocket, and independent suspension allows the vehicle to cover rough obstructions smoothly. Steering is accomplished by disengaging the clutch for either side of the machine. The Centipede can easily haul two days' camping supplies, any size game, and two men over steep trails. Its five-horsepower motor uses about a gallon of gasoline per half-day's drive.

Ted Duke (right) and his brother Harold load up for camping trip. Ten-inch wheels carry over any terrain





Gyroplane "Jumps" 200 Feet at Takeoff

No runway is needed for taking off or landing a Canadian autogyro, the Avian 2/180 Gyroplane. A rotor, normally free-wheeling, serves as a wing; forward motion is given by a ducted fan-shaped propeller at the tail. The Gyroplane cruises at 150 miles per hour, approaches at 20 miles per

hour, and lands vertically. While a normal takeoff run is 100 feet, the plane also can "jump" into the air. The rotor is accelerated on the ground by means of a jet air nozzle at each blade tip. Compressed air is forced through the nozzles, lifting the Gyroplane 200 feet straight up.

Old Cargo Plane Becomes Mobile Home

Australian ingenuity and the fuselage of a Douglas DC-3 cargo plane paid off in a self-propelled mobile home for author Jeff Carter, who combines the front half of the aircraft body with a truck chassis, using the old cockpit as a cab. Carter's family

has accompanied him around the Australian continent for five years in the "land yacht" while he gathers material from sheep and cattle drovers, kangaroo and wild-dog hunters and fishermen, in country where temporary quarters are scarce.





Ground-Controlled Approach Radar Swings on Turntable

Naval ground-controlled approach equipment is being placed on turntables to reduce the time planes must wait to land. Before this technique was devised, every major change in the wind required that the radar-housing unit be laboriously hauled into a new position for alignment with the runway dictated by the new wind direction. Aligning the unit with the runway required 30 to 40 minutes. The turntable al-

lows the radar housing to be positioned within three to ten minutes. It is hand-operated and can be moved by one man. Its use also adds to the life of the equipment by permitting it to be realigned before it cools. Cooling and reheating shortens the life of tubes. First installations have already been made at the Marine Corps Air Station, Beaufort, S.C., and at the Naval Air Station, Dallas, Tex.

Church of Arches

Soaring skyward in a spectacular series of graceful arches, the newly completed Our Lady of Grace Church dominates the landscape at Higüey, Dominican Republic. The topmost arch towers 246 feet above the ground. The church was built at the cost of \$5,000,000. It is a shrine, and millions of pilgrims are expected to use it for worship.

High-Speed Color Movie Film

With a normal exposure index of 160, a high-speed color motion-picture film enables photographers to record poorly lighted scenes and technical subjects for which accurate color and high film speed are essential. The film, Ektachrome ER, daylight type, has been exposed at indexes as high as 500 while recording missile data. Its tungsten-balanced counterpart, type B, has a normal exposure index of 125. The manufacturer describes the film as of "adequate sharpness, moderate grain pattern and excellent color reproduction." It is available in 16-mm. and 35-mm. sizes.





Two most popular types of pirogue—left, hollowed-out cypress log, right, plywood

Racing pirogueman, ready for takeoff. He kneels to get better leverage, and the plastic cover keeps out water during race



Pirogue Race

By Dev Klapp

WHEN 6000 LOYAL French Acadians were exiled from British Nova Scotia in 1755, they were shipped to English Colonies all over the East Coast to disperse them among loyal British colonists. Many of the Acadians, in an attempt to escape British rule, wandered westward to the former French colonies in what is now Louisiana. Their descendants, their name mispronounced "Cajuns," form a large part of Louisiana's population. In those difficult early days, the Cajuns hunted and trapped for a living in the bayous and swamps of the lower Mississippi. They soon found the Central American natives' dugout canoes, called piraguas, to be the best craft for threading between cypresses and live oaks in shallow backwaters, and the "pirogue" became their standard means of transportation. Even today the pirogue is the back-country standby, and the dream of Acadian

parish youngsters is to be a good pirogue-man first and a baseball hero second. Each year, at Bayou Barataria in the heart of the Acadian country, they hold the annual pirogue races, and Cajun experts race lightweight racing pirogues over a four-mile course "to see who's the best man on the bayou." A field of 62 competed when these photographs were made, and the winner, 19-year-old Gerald Evans LeBlanc made the run in 36 minutes to win a cash prize, a trophy, and the acclamation of the marshland people. But the times are catching up with the traditional sport—the standard pirogue is hollowed out from a solid cypress log or built up of paper-thin plywood or planking, roughly 20 feet long and light as a dry leaf to skim lightly over the shallow bayous. But LeBlanc's championship pirogue was lovingly fashioned from modern glass-fiber reinforced plastic.

Jockeying for positions just before the starting gun. Anything goes, short of upsetting a rival's boat
Photos: Louisiana Dept. of Commerce and Industry





Drifting Parachute Snatched by Copter

Parachutes carrying missile nose cones or data capsules may, in the future, be plucked from the air by helicopters before their cargo has the chance to be lost at sea or destroyed by impact with the ground. The aerial recovery technique was recently tried and termed promising by service officers. A Sikorsky S-55 helicopter equipped with a 20-foot boom and a hook attachment made five in-the-air pick-ups. Parachutes were released at an altitude of about 8000 feet; recoveries were made at 1000 to 6000 feet.



Asphalt Blanket Boosts Crops

Excessive loss of moisture through the ground surface, a contributing factor in dust-bowl conditions, might be prevented by a thin layer of asphalt film. Experiments show that special blends, when sprayed over seeded soil, are sufficient to hold moisture in the ground when young plants need it most, but thin enough to allow delicate shoots to pierce it easily. Experimental sprouts are shown.



Quick-Release Lock Collapses 'Chute

Many paratroopers have been killed or injured when dragged by their chutes after landing. A new quick-release lock, that can't be opened accidentally in mid-air, may end all that. Three quick actions unlock it. A protective canvas flap is lifted up, a metal cover is pulled down, and two metal buttons are pressed together. Releasing one of two locks will collapse it.



Portable Electronic Lung

Weighing only 56 pounds, an electronic lung developed in England allows patients with respiratory problems greater mobility than has been possible with iron lungs. The machine, called the Barnes Ventilator, is connected to the patient by two plastic tubes and is, itself, portable. It has built-in batteries from which its transistorized circuit will run for up to 20 hours without recharging. Thus, a polio patient, for example, can be moved from one hospital to another, or between continents by air, with relative ease.



Flying Laboratory

Sometime this year the Bristol 188, an English-built research plane made of stainless steel, is scheduled to take off from a runway and fly at speeds exceeding 1500 miles per hour. The single-seat jet, built at a cost of more than \$14 million, is powered by two de Havilland engines. Observers say it will be used as a flying laboratory which will lead to the design of a supersonic airliner. Since the 188 will take off as a conventional aircraft under its own power, the manufacturer, Bristol Aircraft, claims the plane has a range of speed "probably greater than any aircraft now flying."





Bill Hanna, left and Joe Barbera look over the story board for a television cartoon. Having already established the Huckleberry Hound characters, they're introducing a new feature this fall, the Flintstones

TV HIT FROM A

As Yogi Bear would say, Huckleberry Hound is better than the average cartoon. More than 30 million Americans, from college professors to kindergarten tots, would agree. The television industry agreed—and gave Huck an Emmy award in June as the best children's program. Here's how Huck—and all his strange companions—are reborn each week.

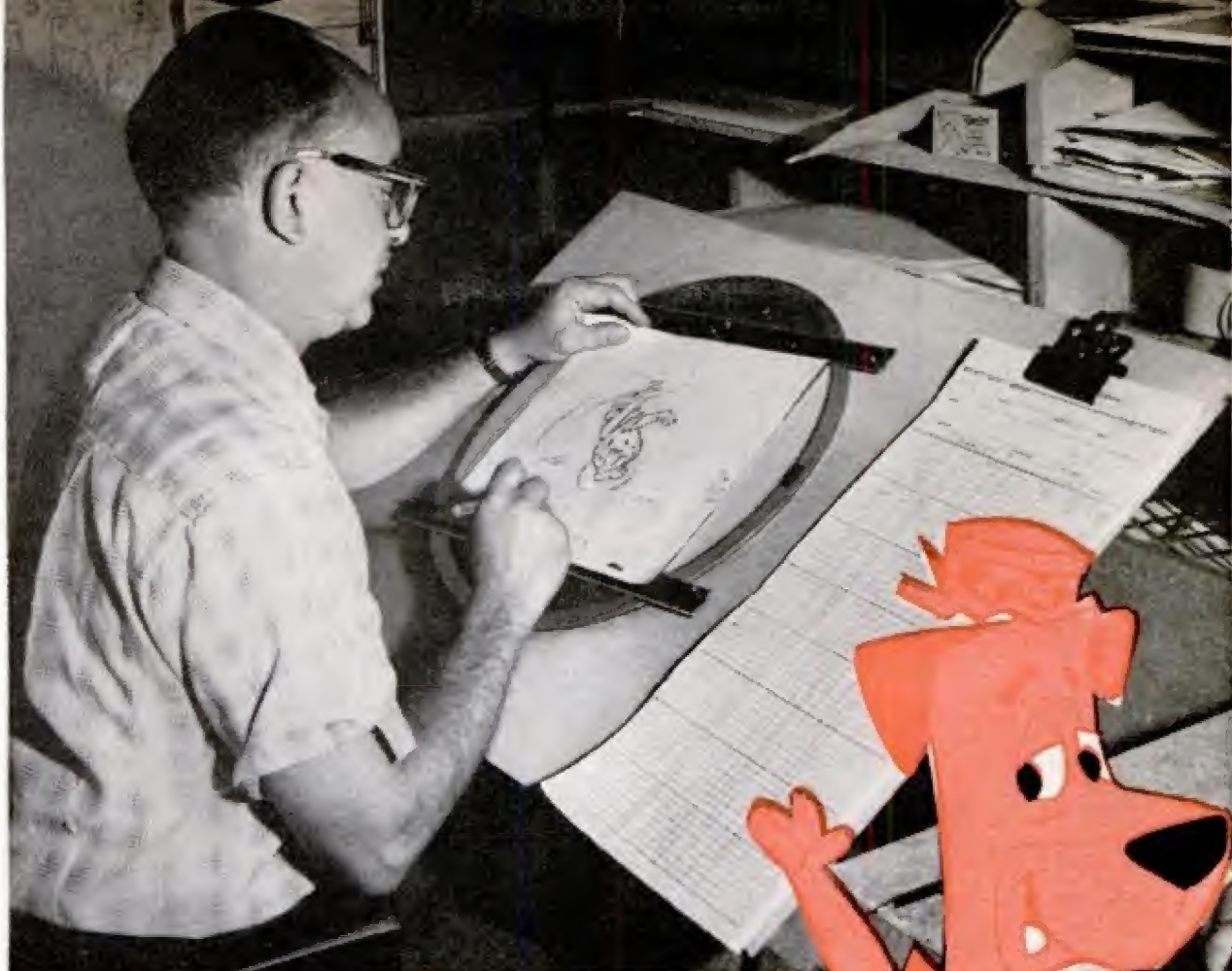


YOGI BEAR
© Hanna-Barbera
Productions

A GROUP OF LITTLE CHARACTERS, whose real selves are scarcely more imposing than the place mats on your table, each week manages to capture the attention of some 33 million U.S. television viewers.

And, remarkable as is the widespread appeal of the animated cartoon featuring Huckleberry Hound (the program is among television's top 10), even more remarkable is the fact that new cartoons appear each week. By ordinary standards, Huck should be just too expensive to produce.

In the past, a six-minute cartoon for theater showing cost \$40,000 or more—enough, anyway, to keep an audience in popcorn indefinitely. On this basis, a half-hour television show—less time for commercials—would cost close to \$200,000.



Animator draws character on easel that's illuminated from below. Notched drawing paper enables him to locate sequences accurately

CARTOON FACTORY

By Thomas E. Stimson, Jr.

PM photos by the author

Advertisers do not readily part with that kind of money on a weekly basis.

So when Bill Hanna and Joe Barbera, two of Hollywood's top cartoon producers, decided three years ago to break into television, they had some sharp-pencil-and-adding-machine type figuring to do. Twenty years of producing MGM's Tom & Jerry cartoons had given them plenty of experience in animation techniques.

They invented shortcuts, new ways of achieving effects and new methods of treating action. They called the results *planned animation*. Planned animation is much less expensive than the typical cartoons of only a few years back—and they've made the films even more entertaining.

Basically, they use the same animation process by which cartoons have always been made.

"First of all, we have to come up with a new story idea," Bill Hanna explains. "Joe Barbera and I contribute some ideas, the writers and other people on the staff contribute others. Next we reduce the story to pictures by drawing a series of rough sketches that outline the action of the plot. These pictures are called the story board, since they originated on the drawing board. A story board for a six-minute cartoon may contain 140 drawings and as many as 600 for a half-hour show."

Once the story is approved, a layout story board is put together—this time with



Long background scene will be shifted during filming to give illusion that animated character is moving

all the technical directions for the different departments written on each drawing.

Surprisingly, the voices of Huckleberry Hound and friends plus all sound effects are recorded before any of the actual animation begins. In the recording studio, the commentator speaks his lines and the characters deliver their dialogue while still in a disembodied state. Daws Butler, an ex-

perienced voice man with a repertoire of more than 25 voices and accents, handles many of the parts.

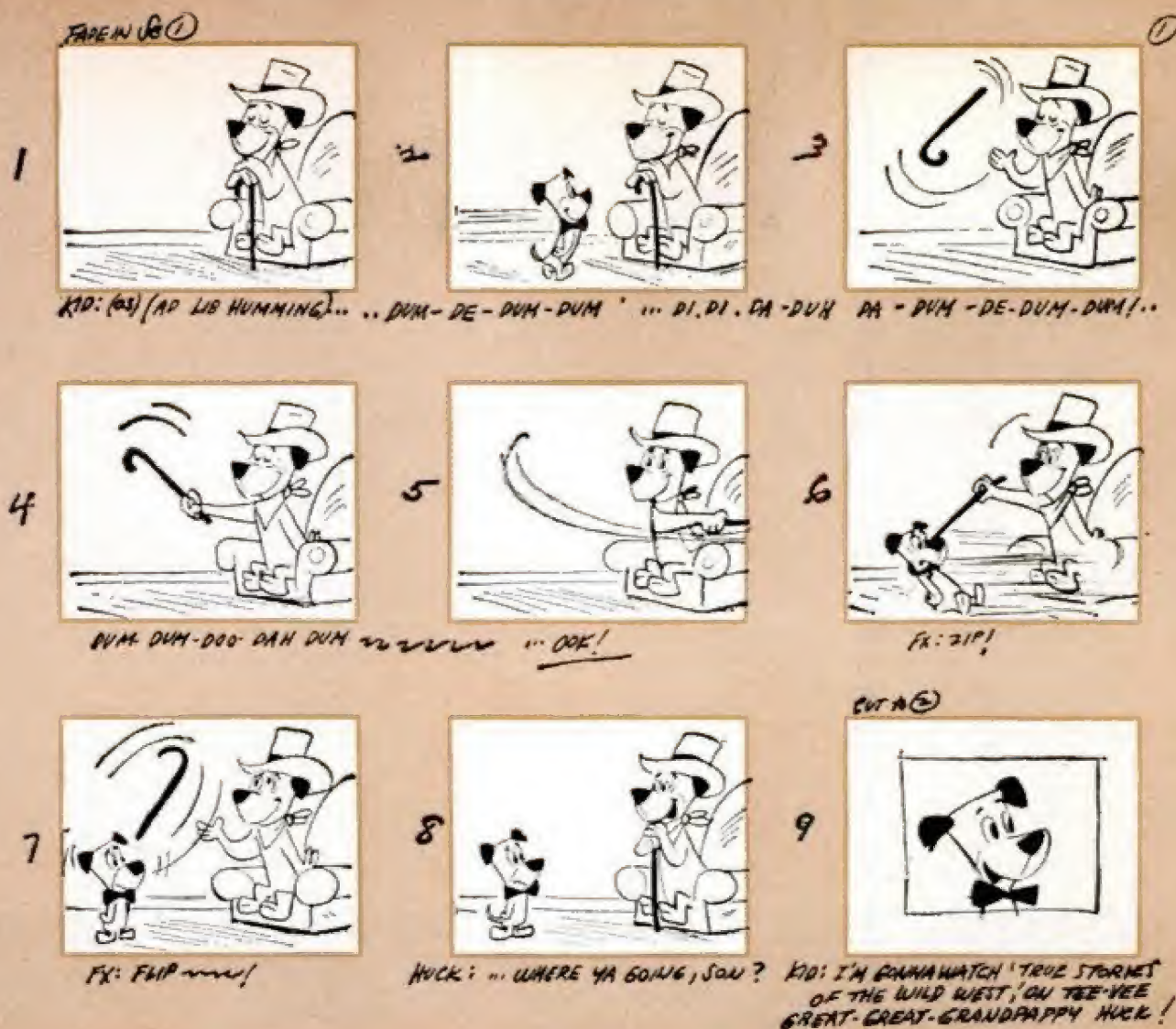
"These recordings are turned over to sound-track editors who listen to them and mark each syllable of speech on what are called animation sheets," Hanna continues. "These sheets will guide the animator so he can allow the proper number of frames for mouth action."

"The animators then make the actual drawings. Each bit of motion calls for several sequence drawings, possibly as many as six drawings to show a character taking a step. The drawings then go to the inking department where a girl lays a transparent sheet of acetate (known as a cel because celluloid sheets were used in the old days) over the drawing and traces in the outlines with a broad pen. From here the cels go to the painting department where they are filled in with color, using quick-drying vinyl house paints. The cels are all painted in color because of the possibility of color television reruns in the future."

Actually, Huck and his friends exist in a rather fragmented way (for which there



Quick Draw McGraw
and Baba Looney
© Hanna-Barbera
Productions



Sequence of rough drawing on story board is first step in reducing a story to pictures for animated cartoon

is probably some psychiatric or medical term). The inkers and painters make very few complete drawings. Huck's body may be painted on one cel, his head on a second, his legs and feet on a third. Stacked in register atop one another, the cels produce the full figure. This technique allows Huck to talk or walk merely by going through a sequence of heads or legs and continuing to use the cels that make up the rest of the body.

Backgrounds are drawn on sheets of heavy paper and form the base under the stack of cels. If a character is to move to the left or right during a scene, a long background is used that shows a series of clouds or trees. The action then is created by moving the background one notch at a time in the proper direction. The animated character merely moves his legs and remains in the center of the scene.

The aim of all this work, of course, is to get the action on film. So each set of cels is photographed with a sequence motion picture camera that exposes one frame of film at a time. The cameraman places the background drawing on the flat easel under

the camera, matches up the various cels on top of it (so that legs, arms, bodies and other miscellany fit together), presses a button to make the exposure and then consults his direction sheet to learn which cels should be replaced for the next exposure. Run at standard speed in a movie projector, the series of still drawings becomes a motion picture.

Animation is no pastime for a man who likes to let somebody else handle the details. It's tedious and time consuming work. At the rate of 24 frames per second, a six-minute cartoon requires 8640 exposures. That's probably more shutter snapping than you'll do in a lifetime with your Baby Brownie . . . and you might miss the whole 8640-exposure sequence if you leave your TV set to put the cat out. That same six-minute cartoon may also require as many as 14,000 cels. A half-hour TV show consumes more than 43,000 exposures in all.

Until TV cartooning came along, a cartoon often was more expensive to create than a live action movie of the same length. A single six-minute short took all of six weeks to produce.

AND - A - HOUND - DOG'S

1 2 3 2 1 1 4 5 6 7 6 6 6 5 6 7



Here's how Huckleberry Hound's mouth moves to form the words "and a hound dog's howdy to you." Each of the cells is a transparent acetate sheet on which the features are drawn. By laying each of the numbered acetate sheets over the close-up of Huck (in which his mouth is missing) and photographing them one at a time in this sequence, his mouth positions are made to correspond with his bucolic canine greeting

Inker uses broad pen to trace outline of original drawing onto cel; next step is to paint the characters



— HOWDY — TO — YOUUU

7 2 1 5 7 2 2 7 5 5 6 5 8 9 9



Today, with about the same size crew, Hanna and Barbera are producing as many as six shorts a week in the Hanna Barbera Productions studio.

"One thing we do is take advantage of the small size of the home television screen," Joe Barbera says. "The small screen calls for close-ups instead of theater-wide scenes with babbling brooks and falling leaves in the background. We even like close-ups of a character's head instead of showing his full body, just to avoid the necessity of making more drawings.

"We've reduced the animation of speech to nine standard mouth positions, and a character has a full vocabulary with these nine expressions. More than that, you'll notice that we often finish a speech with a still picture of the character who is listening. Nothing is lost by this, and we can use the same drawing of the listener for many, many frames.

"Another thing, all the characters move either to the left or right, rarely away from you or toward you. This eliminates the need for tricky three-dimensional effects that require numerous separate drawings."

Other savings were achieved by eliminating entire departments, such as the test camera department formerly used to photograph each drawing before inking and painting. Too, the music sheet department in which cartoons were once timed to music is no longer used.

The biggest saving of all was obtained by eliminating the work of the *in-betweener*. Previously a chief animator would make most of the important drawings, and his assistant would fill in with some of the others. Additional sequence drawings, to be placed between the others, would be drawn by the *in-betweener*, actually a sec-

ond assistant animator. His drawings accounted for half the cels.

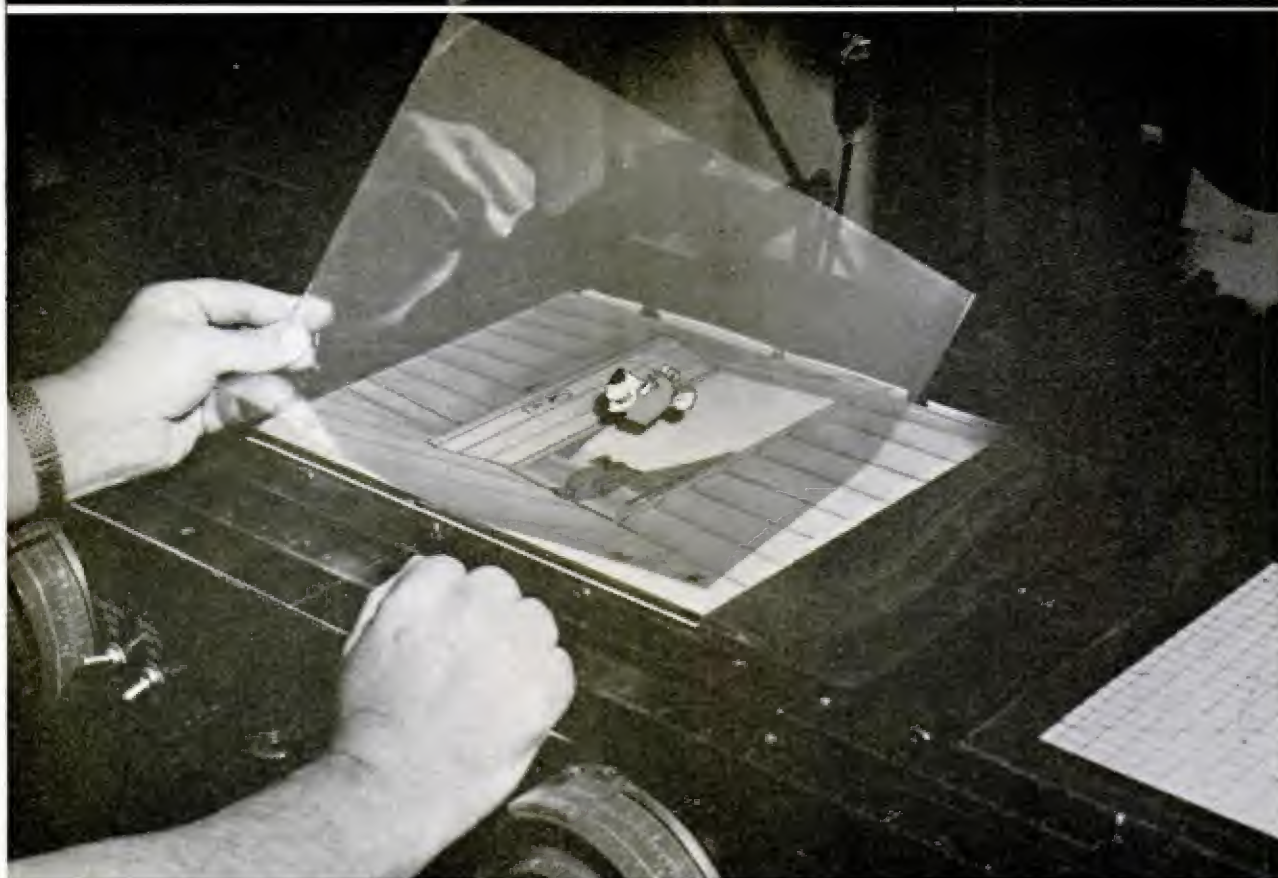
By eliminating the in-between drawings, the number of cels is reduced by half. To make up for this, each cel is shot twice by the camera, on two frames of film. Thus each drawing is seen for $\frac{1}{12}$ of a second when the film is projected instead of $\frac{1}{24}$ of a second. Action is speeded up, yet not to the point where it is jerky or displeasing. The cartoon effect is enhanced.

All this tells the story of how cartoons can be produced cheaply enough for television but it doesn't explain the universal appeal of the Hanna and Barbera animations. College professors as well as school children, engineers and kindergarten tots all delight in Huckleberry Hound.

"Part of the reason is that we have returned to the basic idea of a cartoon," Joe Barbera says. "In the old days of theater cartooning the animators tried to imitate people and animals as closely as possible in actions and voice. Cartoon effect was lost and results were not always funny.

"Today we exaggerate a character's appearance and actions on purpose. We hunt for plausible story situations and we use satire and absurdity and slapstick. In a sense it's a return to the old Punch & Judy shows. We use simple drawings without too much detail. The result is fairly good comedy, good cartooning.

"The fact is that we used to make good cartoons in the old days and then throw them away. As soon as we had a story we'd make a 'rough' preview reel to see how the story looked. The action was fast, everything was exaggerated and the effects were pretty hilarious. After looking over this rough we'd go ahead and produce the slower-paced animation. Today's cartoons to a great extent are the roughs of the past."



Two cels (background and character's body) are already in place on easel as cameraman places third cel (showing head) over them. After taking picture, he'll substitute slightly different head action for next frame

The results have scored with viewers and with the industry. Not only is the Huckleberry Hound show distributed via 192 outlets in the U.S. and Canada, it has gone world wide as well. Much of Europe, most of Latin America, and Japan and other parts of Asia watch the Huck show every week. As if this weren't enough to keep the producers' cup running over, they were given the Emmy award for the best program in the children's field at the 12th annual TV award ceremony in June.

Cartooning is so popular, in fact, that about a year ago Hanna and Barbera introduced Quick Draw McGraw, a separate TV show that satirizes the gunmen of the old wild west. And more recently a third show known as Ruff and Reddy was put on the air, telling the story of a cat and dog that work as a team.

Television has to have commercials, of course, and in the Huck show the principal characters also appear in the commercials. Audiences don't find this objectionable at all, mainly because the characters retain their identities and continue to entertain.

Just like the rest of Hollywood, the animators are finding that they have fan mail and "star" problems. Yogi Bear, one of the main characters in the Huck presentation, has become so popular that he is being considered for a star part in his own show. And sometimes a character that is used once or twice and then dropped has to be returned. Fan mail demands it.

With their new techniques Hanna and

Barbera have also made a return to theater cartooning. Now being distributed by Columbia is their Loopy de Loop series that is designed for theater audiences.

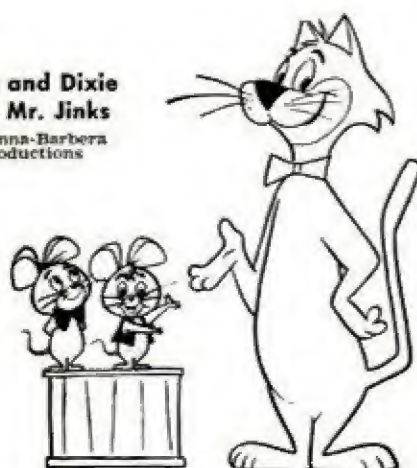
Also new this fall is the Flintstones, the continuing story of the trials and tribulations of a prehistoric family. The Flintstones live in a cave and carry clubs, but it turns out that they have all the problems and anxieties of modern civilized life. Starting in late September the Flintstones will be on the air for half an hour beginning at 8:30 every Friday evening. This is prime time on television, time for which a cartoon never before was even considered.

"It's a show intended for grownups," muses Bill Hanna, "but I suppose the kids will be pushing their parents away from in front of the screen so that they can watch it too!"

★ ★ ★

Pixie and Dixie
and Mr. Jinks

© Hanna-Barbera
Productions



POPULAR MECHANICS

Light Utility Car For Work or Play

Compact economy entered the field of utility cars with the introduction of the Saviano Scat, by Saviano Vehicles of Warren, Mich. The two-door, four-passenger convertible has an 80-inch wheelbase and weighs only 1700 pounds; the 25-horsepower air-cooled engine delivers 25 to 30 miles per gallon, and the Scat has a top speed of 50 miles per hour with a three-speed straight transmission. Developed both for industrial and sporting use, the Scat also is available for indoor industrial use with propane for fuel. The body can be opened up for big carrying capacity.



Two-Story Camper

Most of the problems of vacationing with seven children were solved by a truck camping body designed and built by Capt. and Mrs. Paul J. Wolf of Fairborn, Ohio. The special body fits onto the chassis of a half-ton pickup truck. The double-decked camper sleeps all nine Wolfs and provides riding and play space on the road for the children.



Skindiver's Sonar

Navy frogmen working in the dark or in murky water can locate underwater objects electronically with a new portable sonar system. The 20-pound, basketball-sized outfit is powered by standard flashlight batteries; the diver-operator uses underwater earphones to get audio information on any object detected by the sonar beam. Sealed into an aluminum casing, the unit is self-contained, and has negative buoyancy for easy handling under water.





Mobile Telephone Center Provides Service to Public and Press

Ready to roll to the site of major news events is a new, 32-foot-long mobile telephone center operated by the Illinois Bell Telephone Company. It carries 15 telephones, including two mounted outside the bus body. Ten mobile radio-telephone channels provide communications anywhere; it has a public-address system as well as two power units.

Mechanical Depth Finder for Fishermen

Smart fishermen study their geography under water, because the one who knows the reefs and bars and deep holes often has the best chance of catching fish. But mapping the bottom of a lake or even finding the depth at one spot can be quite a job. A new mechanical depth finder does the job easily by releasing a weighted line and registering the amount paid out on a graduated dial. The release lever is also the retrieving crank. It's available in 50-foot or 100-foot models.





"Sausage" Barge Carries 35-Ton Cargo, Then Rolls Up for Trip Home

Going up the Solent toward Southampton, England, a new "flexible oil barge" carries 10,000 gallons of oil or 35 tons of other cargo—liquid or solid—behind a small motor launch. This 100-foot-long, five-foot-diameter model is undergoing commercial trials. Much larger containers

are being planned. Called a Dracone, the rubber-impregnated nylon bag tows easily to its destination, then can be rolled into a compact bundle and shipped back to the cargo source for another load. It is especially useful on inland waterways in West Africa and the Far East.

Skirt Boosts Lure's Allure

By increasing the light reflectance of any fishing lure, a new self-sticking plastic skirt makes it as much as three times easier to see, and more attractive to fish, especially in cloudy water. Six of the $\frac{5}{8}$ -inch skirts come on a card; each has five "tails" and a waterproof adhesive base that sticks to anything. They are available in gold, silver, and six colors; $1\frac{1}{2}$ or 3-inch sizes; either pinked (as shown) or straight.





WHAT'S NEW FOR Your Home

ELECTRIC GRILL for outdoor use has a spate of push-button controls. Located on one side is a console with off-on buttons for a built-in fire starter (which ignites charcoal), starter warning light, rotisserie motor, night light; it also has an automatic timer with bell alarm and an outlet for electrical appliances. The grid may be arranged to grill, simultaneously, meats rare, medium and well-done

Union Steel Products Co., Albion, Mich.

DAIRY REMINDER allows a housewife to leave an order or make changes in one without interrupting other activities in order to deliver it personally to the route man. The 4 by 8-inch "reminder" is made of white weather-resistant plastic and permits ordering by peg-board selection. There is a tilted slot on the back for coins and milk tickets

Anga Specialties, P. O. Box 128, Avoca, Penn.



† **PEG POLE** utilizes normally wasted space for holding such things as towels, shelves of condiments. Two combine to form a room divider. Accessories slip into its many slots

House of Fiske,
1237 West 47th St., Chicago 9, Ill.



POPULAR MECHANICS



ADJUSTABLE RAKE sweeps leaves, loosens soil, rakes dead grass and spreads seed. It is set to perform any of these tasks by loosening a wing nut and moving the handle up or down, or sideways, to vary the tension on the tines and the position of the handle
Braun Manufacturing Co., Inc., 1635 N. Kostner Ave., Chicago 39



ELECTRIC RANGE with overhead ovens features some space-saving innovations. The oven doors, for example, glide up out of the way rather than pull down. The cooking surface pulls out, like a drawer, at a 32-inch work height. The range is free-standing
Frigidaire Div., General Motors Corp., Dayton 1, Ohio

CONDIMENT SHELF built in three steps provides large storing capacity for a small area. The 8 by 10-inch shelf is made of formed wire. It has a chrome finish, and rubber tips on the feet protect the counter or table surface. Labels of canisters are always in view
Stanley Products Co., 1026 Milwaukee Ave., Chicago 22



BATTERY-POWERED MANICURE tapers cuticles; shapes, files and trims nails of both hands within minutes. It is powered by flashlight batteries and has a silicon-carbide shaping disk and a buffing attachment. It may also be used for removing dry skin
Thompson Designs Inc., 3550 Martens St., Franklin Park, Ill.





Ten-foot length of steel culvert provides grizzly trap body; door drops over opening when trigger is touched

Canadian Conservationists Work to Save Grizzly Bears

Last stronghold of the great grizzly bears that once hunted bison across the northern plains, the Swan Hills area on the shore of Lesser Slave Lake in northern Alberta has been declared a bear

Volvo Unveils Sports Coupe at International Auto Show

Companion to the popular Volvo sedans, the new Volvo P-1800 sports coupe was introduced at the International Automobile Show at New York Coliseum in April. Based on standard units already in-

cluded in the other Volvo cars, the P-1800 is powered by a 1780 c.c. (108.5 cubic inch) four-cylinder engine producing 100 hp. for "a very high top speed." It has a four-speed transmission; optional overdrive.





Air holes plugged, ether is sprayed into the trap

sanctuary. Albert A. Oeming, Edmonton, Alberta, wrestling promoter and a top zoologist, led the drive to locate the bears' range and establish the preserve, and developed the grizzly trap above which al-



Out but unharmed, bear is tagged and trucked away

lows live capture and tagging. Oeming's method of capturing the bears and re-locating them on the sanctuary is believed by conservationists to have saved the species from almost certain extinction.



New Infantry Weapon in Production

Called "the best in 20 years," the new Colt combat rifle, now in production, is unique in its versatility. It will fire semiautomatically with sniper-rifle accuracy, or will fire 720 rounds a minute as a machine gun. It weighs only 5 pounds, 11 ounces fully loaded with 20 rounds.



Left, polishing a carving of walrus cow and calf; right, a favorite subject, an Eskimo mother and child

Eskimos Carve Soapstone

By **Richard Harrington**

Photos by the author

ESKIMOS of the tribes around the upper shores of Hudson Bay have carved soapstone for many centuries. Sensitive, creative, and imaginative, the natives of that frozen land are thought to have begun the practice for occult purposes, carving images of their many spirits, talismans for hunting, or charms for witchcraft, passing

the time in their often-snowbound igloos by shaping chunks of relatively soft steatite, or soapstone. Strangely once a carving was finished, the artist lost interest, discarded it and began another.

Twelve years ago, James Houston, a young Canadian artist, penetrated to the east coast of Hudson Bay on a painting ex-



At the Povungnetuk quarry, members of the Sculptors' Society chop out pieces of soapstone. They pry it out with axes and ice chisels, cut it to shape with handsaws and hatchets, strange tools for such fine work



Left, lucky trapper carries one fox, picks up another; right, Charlie Sheeguapik, Sculptors' Society president

pedition and encountered some of the carvings, which were then being handled by the local trading posts as novelties without much success. Greatly impressed by the primitive artistry in the figures, Houston carried several pieces back to Montreal to the Canadian Handicrafts Guild. The rest is history—collectors snapped those few pieces up, the Eskimo sculpture caught on and was publicized, and pieces are now being shipped all over the world and sought as collectors' items by art fanciers, decorators, museums and housewives alike. In-

deed, the reputation of the Eskimo work grew until it received the highest accolade—imitation. Japanese craftsmen began turning out "Eskimo art," and sold quantities of it in British Columbia. Now, however, all genuine pieces are signed by the Eskimo artist and carry his government serial number.

(As if in retaliation for this imitation, the Eskimos, again aided by Houston, learned the Japanese techniques of printmaking from incised soapstone carvings, and are now profiting from this new art form.)



Quarrying the soapstone is the start of the carving process; they never make sketches, but take inspiration from the shape of the rough stone. Charlie Sheeguapik loads a sled and plans his work at the same time





Sheeguapik carves an incident in stone—a hunter, aided by a sled dog, cutting the throat of a young caribou. From top to bottom, the finishing process, first a rough file for final shaping, then sandpaper for details, then buffing with a soft cloth wrapped over the file to bring out the stone's lustre



One of the centers of the new business is Povungnetuk, on the northeast coast of Hudson Bay, where soapstone is readily available in a primitive "quarry," eight miles outside the settlement.

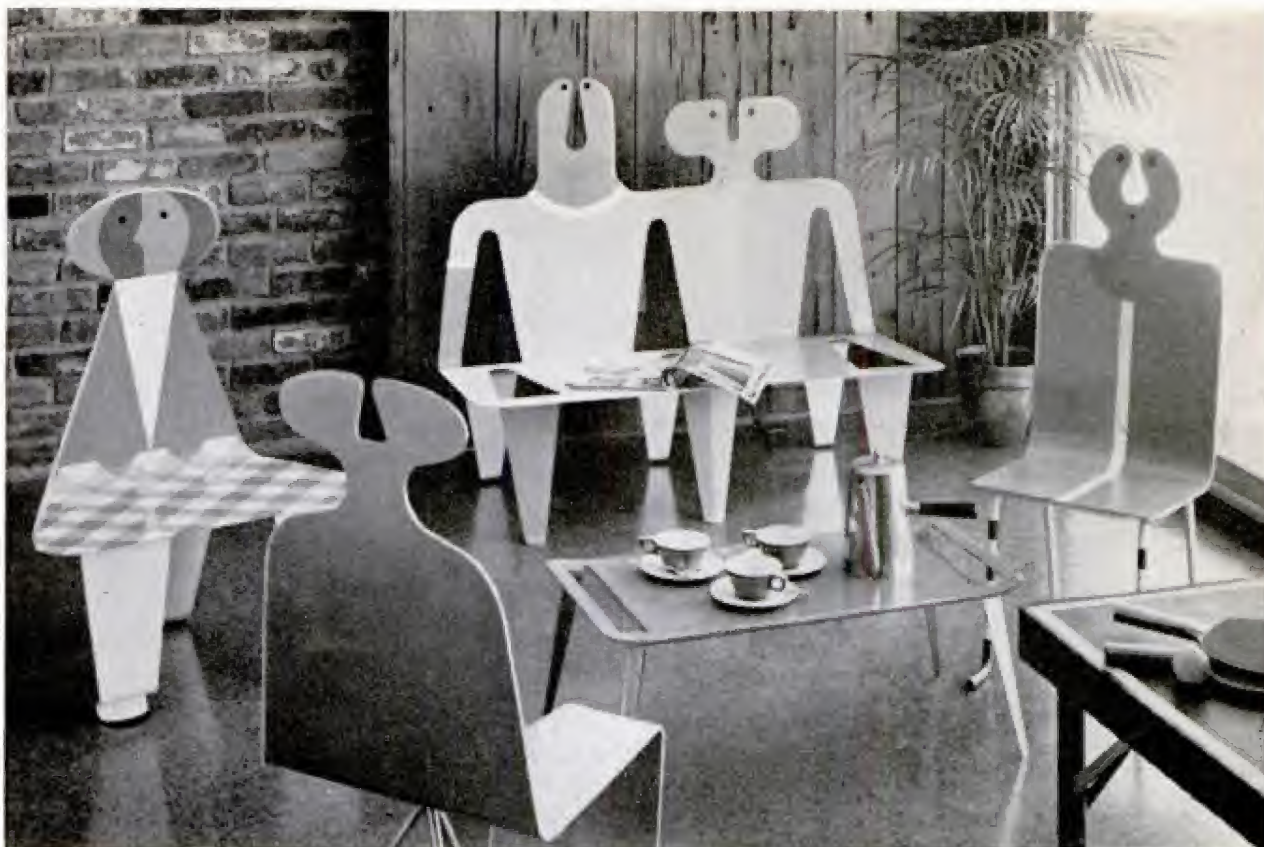
The Povungnetuk carvers make a group excursion out of their quarrying, gathering several co-workers and taking several sleds at once to their "quarry," which is actually an outcropping of pyrites which contain pockets of the softer steatite. They chop and hack out chunks of the soft stone and haul it to their homes for carving. A trained sculptor would scorn their tools—ice chisel, mallet, ax and saw for the cutting, and files or sandpaper for finishing. The carver sits contentedly in his igloo, legs stretched out in front on his snowbench, usually working barehanded in near-freezing temperatures and often barely able to see his work through the smoke of his seal-oil lamp, a dim light at best. One of the reasons for the smooth simplicity of Eskimo sculpture is that a great deal of it is done almost by touch in the dim igloos.

Subjects are usually from the artist's surroundings, but vary otherwise from artist to artist. Some prefer to work with small pieces, carving birds or walrus or seals; others undertake larger subjects, even groups of figures. Some show more imagination than others, and a few less-skilled carvers are inclined to copy an idea or shape—though not the actual carving—that has proved successful and sold well.

When the work is completed, the members of the Sculptors' Society of Povungnetuk gather in the Eskimo Room of the Roman Catholic Mission to decide on its worth. They estimate a price on a ballot (you can always tell which estimate is the artist's—it's the highest) and usually decide on a value around the middle of the price spread. The Society then deducts the cost of air shipment and credits the balance to the sculptor's account at the trading post. Prices range from five to one hundred dollars, rarely more, and air freight costs 50 cents a pound.

James Houston is now settled at Cape Dorset, working as civil administrator for the Canadian government and handling the output of carvers in that area; they gross over \$150,000 a year, earning half of Cape Dorset's income. And the 400 Eskimos at Povungnetuk are happy, well-fed, and warmly clothed, thanks to his efforts and their hobby. ★ ★ ★





Whimsical Aluminum Chairs Look Like People

It's a cinch you'd never feel lonely in a setting like this. These "People Chairs" were done by designer Jay Doblin for the Aluminum Company of America's program of designs for the future in aluminum. The

whimsical seating pieces reveal a new approach to the manufacture of furniture, that of folding items from a single piece of aluminum. People chairs are experimental and are not currently being sold.

Tiltable Tower Tests Radomes

How much does a radome deflect the radar signal being picked up by the antenna it houses? General Electric scientists have built a huge tower to answer that question. Despite its great bulk and weight—120,000 pounds—the tower is a precision testing instrument. It consists of a tiltable platform coupled to a stationary steel framework; the platform can be moved through 41 degrees, on only one axis, with such accuracy that the angle of tilt is achieved within $1\frac{1}{2}$ minutes of arc. The tower is installed at the company's antenna development facility near Cazenovia, N. Y. Radomes of various designs can be mounted on the tower's framework to find out how much they deflect the radar signal.

☐ Swiss cheese and charcoal will filter 90 percent of the tars emitted by common cigarette brands, according to a University of Wisconsin professor.



DIKE WATCHER

NIGHT AFTER NIGHT, day after day, the North Sea licks greedily at The Netherlands' coast. Earth is washed away, a boulder tumbled, water trickles from a stone and a dirt wall. Each destructive sign is noticed by the men and women who protect the dikes and battle the sea. Their land is vulnerable to attack for much of the country is below sea level. So the watchers, as organized as an army, patrol day and night. They look for gaps in the walls, for erosion, for storm signs, for changes in the water level. Typical of the watchers is a grizzled farmer named Jan. Sometimes his patrol ends with a skirmish; sometimes it begins that way. One stormy night, the sea lashed its thundering water again and again across his land. These pictures show Jan's mission that night.



Howling winds of a North Sea storm whistle about his home as Jan goes on a dawn patrol of a coastal area



His son helps pitch out sandbags for shoring-up the storm-weakened earth and stone walls of the dike



Jan calls the headquarters for dike protection at The Hague, the capital, to relay damage information



Water is splashing around the wall when Jan closes the gates which shut off the road leading to the harbor on top of the dike. Since the sea has already weakened the dike walls, Jan and son jam sandbags into the gap, right. Dike watchers employ telephones and trucks for quick operations throughout maintenance system

Ebb tide reveals the extent of the sea-wrecked damage and the watchmen start repairing the dike, one of many that keeps the water from flooding over their reclaimed farmland. First they build a "coffer dike" from basalt blocks at right angle to the dike so that at high tide the sea near the work area will be calm





Portable, Electric Smoke House

Up to 10 pounds of meat or fish may be smoked in a new, portable smoke house. The unit contains an electric coil at the bottom over which hickory chips are laid to provide smoke, and removable racks on which the material to be smoked is placed.



Portable Refrigerator

Operating on either a car battery or on a small can of LP gas, a 25-pound portable refrigerator works on the absorption principle with no moving parts and thrives on movement in a car or boat. It will hold 25 pounds at 45 degrees on a 95-degree day.



Army Has Movable Missile Tower

Although it's 151 feet tall and weighs 350,000 pounds, a new servicing tower for such missiles as Redstone and Jupiter moves on pneumatic tires. It is mounted on two base trailers of six wheels each and contains platforms for servicing-specialists as well as elevators and fueling equipment. Previous towers were either fixed or rail-mounted.

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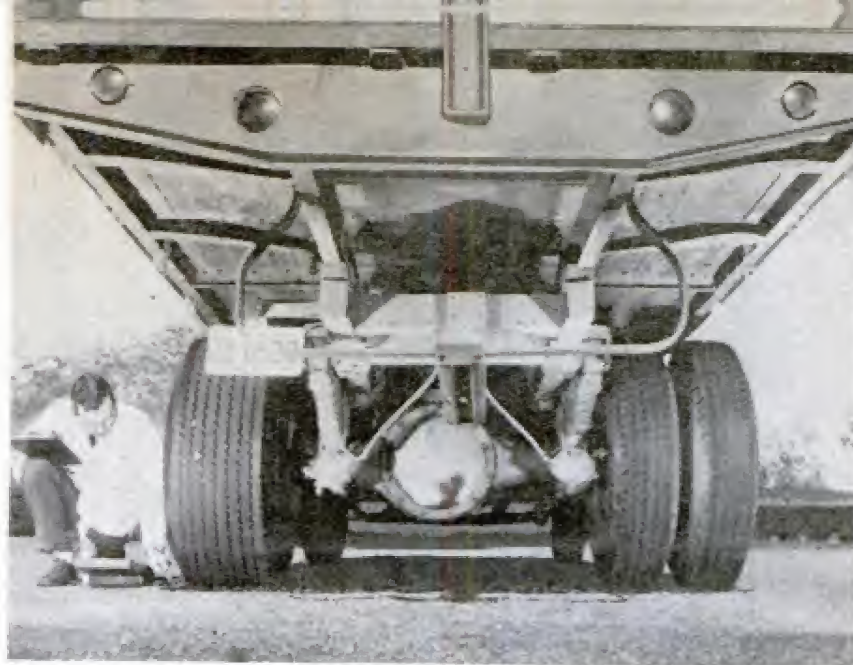
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Jumbo Truck Tire Replaces Duals

Twice as wide as a conventional truck tire, the new Firestone 18x19.5 experimental truck tire is intended to eliminate the need for dual wheels on trucks. Besides convenience, its advantages are lighter weight, softer ride, fewer parts, smaller space requirements, greater off-road performance, and never any damage from rocks or other objects wedged between tires.



Mechanical Hand Picks up Brush

Thorny rose cuttings, palm branches and other spiny stems left by Phoenix, Ariz. residents for trash pickup are easily handled by a clamshell bucket developed by a member of Phoenix Garbage Service Company. The clamshell "hand," which can rotate 360 degrees, operates at the end of a jointed arm. Recently the rig picked up in 15 minutes a load of palm branches that would previously have taken a loading crew over five hours to handle. The hydraulic device was developed by Larry Redmond.



Bean Harvester Does Three Jobs

Experiments at Cornell University indicate a new bean harvester can perform in one simple operation the three-step task of pulling, raking and gathering beans. The machine fits a standard combine. It thrusts short rubber fingers among bean plants, lifting them so a moving blade can cut the stem below the bean pods. Its inventor, Professor Wesley Gunkel, says the device has performed successfully on bean plants of several sizes. Further experiments are under way.





Target! But is it man or game? You'd better be sure, but if it's a deer, you'd better be fast, too

First, a mechanical checkup, to make sure the action is working properly, the safety is operating, and the barrel is clear. Right, target inside a bouncing, rolling tire is as tough a target as any game animal





Two men and an inexpensive hand trap can produce some fine practice for upland game-bird shooting

Rehearse for the Hunt

By Russell Tinsley

IF YOUR BOSS suddenly announced that you were to take a job-efficiency test, you wouldn't think of tackling it "cold." You'd brush up on the more important aspects of your livelihood so that you'd be reasonably sure of passing. This seems like the logical approach to any similar situation; yet an estimated 65 percent of our nation's hunters take their weapons from storage each fall, whip off a year's accumulation of dust, and go afield without ever firing a practice shot.

This approach is really hard to understand, because with some basic practice a hunter would be increasing his chances of bagging game considerably, and he might even be sharpening his visual perception and reflexes to prevent a crippling or fatal mishap in the woods.

Either of those reasons should be sufficient to prompt you to get out your pet

hunting piece and condition your shooting eye and reflexes for the forthcoming hunting seasons.

Practice needn't be dull, though. In fact, it can be fun. Simply banging away at an inanimate paper target can get boring, and isn't the best practice, either. In the field there are no so-called pattern shots like those encountered on a target range. Each chance is different and must be dealt with individually. The successful hunter is one who can size up a situation in a split-second and adapt himself to that particular situation.

That's why I like to make a challenging and interesting game out of preseason practice. It not only makes otherwise dull routine more enjoyable, but also it improves my hunting technique and field-shooting ability—and even makes me more safety conscious.



Above, another difficult target — and one that doesn't require a partner—target inside a swinging tire

Right, how could anyone confuse a deer with a man? From the number of accidents yearly, it must be easy

Below, loose balloons bouncing along the ground (in front of a backstop) imitate running game



My companions and I always practice in the very woods where we'll be hunting later on in the year. There are two reasons for this. One, we'll be simulating the actual conditions which we will encounter when after live game and second, we are far away from "civilization" and won't be endangering others. Our two cardinal rules are to make sure of our target before we squeeze the trigger and to know the area where we are shooting.

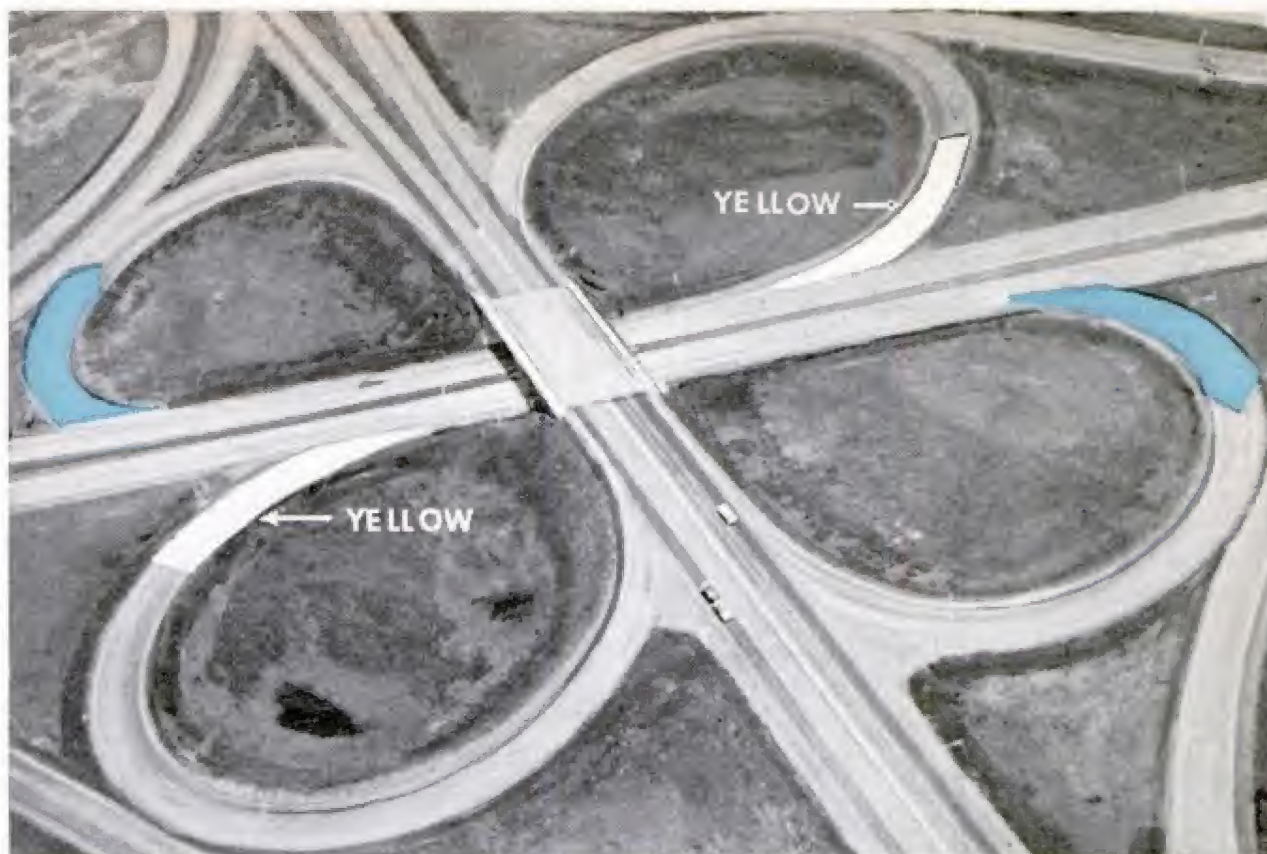
Our favorite preseason practice is called "the silhouette game." We improvise life-size silhouettes of both the game we are hunting and of a human form. Ours are crude black paintings on ordinary cardboard (the cartons that mattresses come in are fine for this). But to be more realistic you might paint the game animal—a deer, for instance—in its true colors and put the human in a red or yellow jacket.

We make a half dozen of each silhouette figure, then one of our party hides the cardboard squares along a marked trail. The idea is for the hunter to still-hunt along that trail, searching for the silhouettes hidden in the underbrush. When he spots one he must first determine whether it is game or human. If it is game, he has five seconds to get off his shot. This way he'll be taking spontaneous shots much like the ones he'll be called on to duplicate in actual hunting.

Our score sheet reads like this: Ten points for a hit in a vital area of the animal (head, neck or heart-lung area); two points for just a hit; a minus five points for a complete miss; minus ten points if the hunter points his weapon at the silhouette and it turns out to be a human shape (we stress the positive identification angle above all others); minus two points if he fails to see one of the hidden silhouettes; and complete disqualification and disgrace if he shoots at a human silhouette. The one who scores the highest number of points wins, naturally. The one with the least ends up buying lunch for everyone else.

A different twist to this game is to station the silhouettes across a draw or canyon with the hunter walking down one side and looking for the cardboard squares on

(Continued to page 234)



Colored Concrete for Safer Superhighways

Greater safety for motorists entering and leaving multilane superhighways may result from an experiment in color coding of entry and exit ramps at interchange of U.S. Highway 61 and Minnesota 36. Por-

tions of entry ramps are painted with yellow reflective paint to caution drivers of coming merger into high-speed lanes. In contrast, lanes to exit ramps are blue to warn of slowdown for the curve ahead.

How About a Breath of Oxygen For an After-Work Pick-Me-Up?

Parisians who have been cooped up in a stuffy office all day can now step inside a drugstore on the Champs Elysees and get a breath of pick-me-up. Just inside the door is a cabinet vending machine that supplies pure oxygen with a perfumed scent for people in need of quick energy. For one franc (about 20 cents), customers get a chance to inhale 20 liters of pure oxygen.

Twigs Grow After Deep, Deep Freeze

Working to develop a method of "training" trees to withstand cold, Russian scientist I. I. Tumanov has succeeded in freezing birch and black-currant twigs to 423 degrees below zero F., then making them grow after thawing. The freshly-cut twigs were first "hardened" by being gradually chilled to 76 below, then immersed in liquid nitrogen. The twigs grew buds and roots normally after the freezing, but other twigs of similar stock, which were frozen without the hardening process, died at 40 below. Botanists believe that the work may prove helpful in developing hardier fruit trees.



MIRROR MAGIC

SPECIAL-EFFECTS MEN have dazzled movie and television audiences for years with lights, shadows, and super-imposed animated figures to create an effect, attract attention, or to photograph an unphotographable idea like Tinker Bell in *Peter Pan*. Probably the most startling and effective of all these are the dancing and floating figures thrown onto your television screen by a process called Mobilux. You've seen it on the Ed Sullivan and Ernie Kovacs programs, and in many fanciful forms in commercials. You'll be seeing it in your home and schools in do-it-yourself kits and on a complete network program soon.

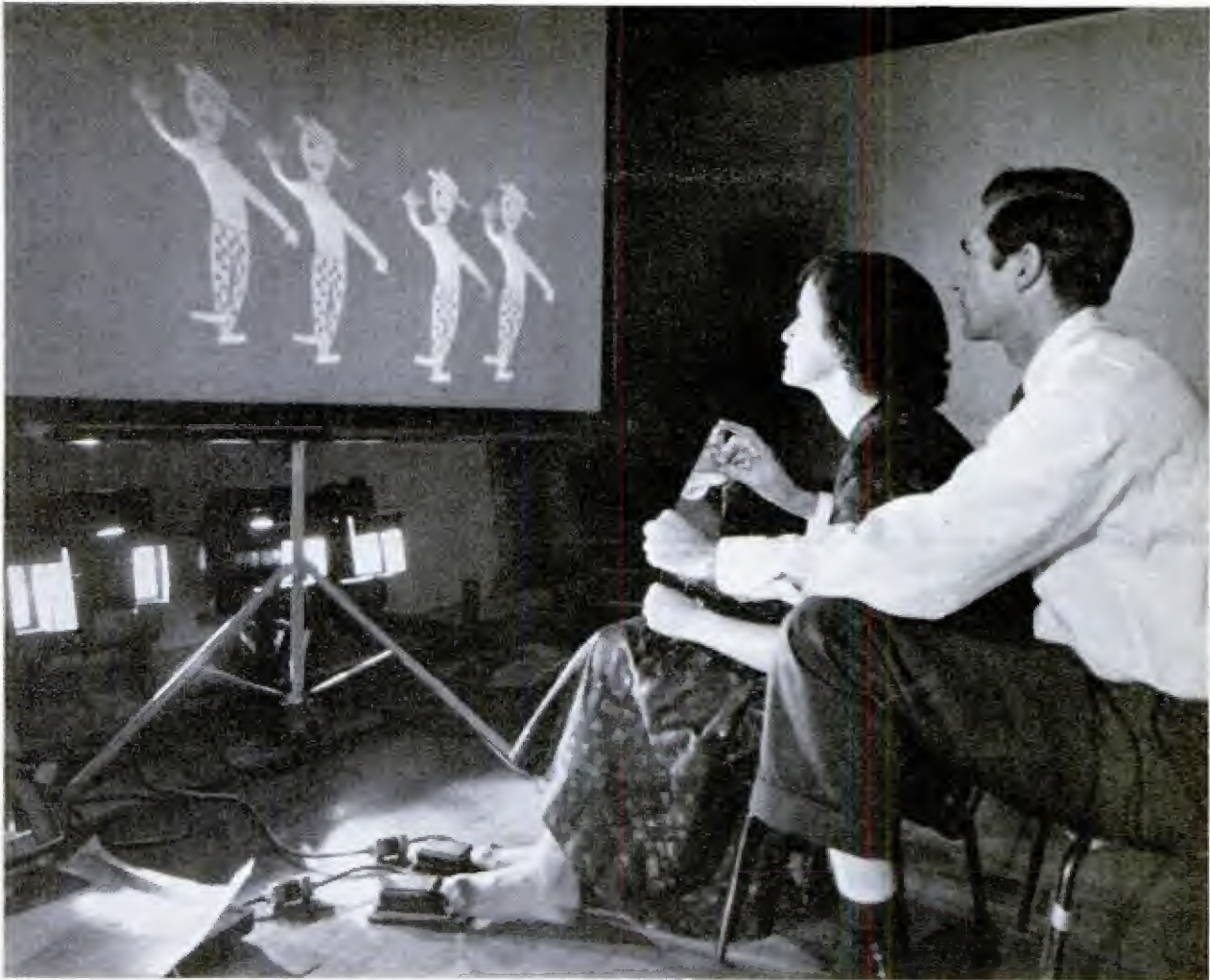
Like a lot of good things, the Mobilux system is the simplest, yet most ingenious, method imaginable. Here's how the inventors, John and Dotte Hoppe, produce their seeming magic . . .



John and Dotte Hoppe with two elephantine "friends"—the figures were cut from aluminum-coated, flexible plastic, with details painted in and backgrounds painted out as shown on the sample figure below

Strong light source from behind a screen is reflected from the polished aluminum onto the screen like sunlight from a signal mirror. When the flexible mirror is manipulated by hand, its reflection seems to move across the screen. The image is picked up from the screen and used alone or superimposed on another





For more figures, simply add more light sources, and one cutout can become a whole chorus line. Here the Hoppes cooperate, John on the head and arms and Dotte on the feet, and the result is a very realistically animated image, without the time and expense of animation, but with infinite flexibility of action

Demonstrating the versatility of the Mobilux system, John Hoppe produces two very different triple light patterns from one floral figure and three spotlights. In practice, he and Dotte, with as many as two assistants project onto the same screen, working lights with their feet while the camera aims over their heads

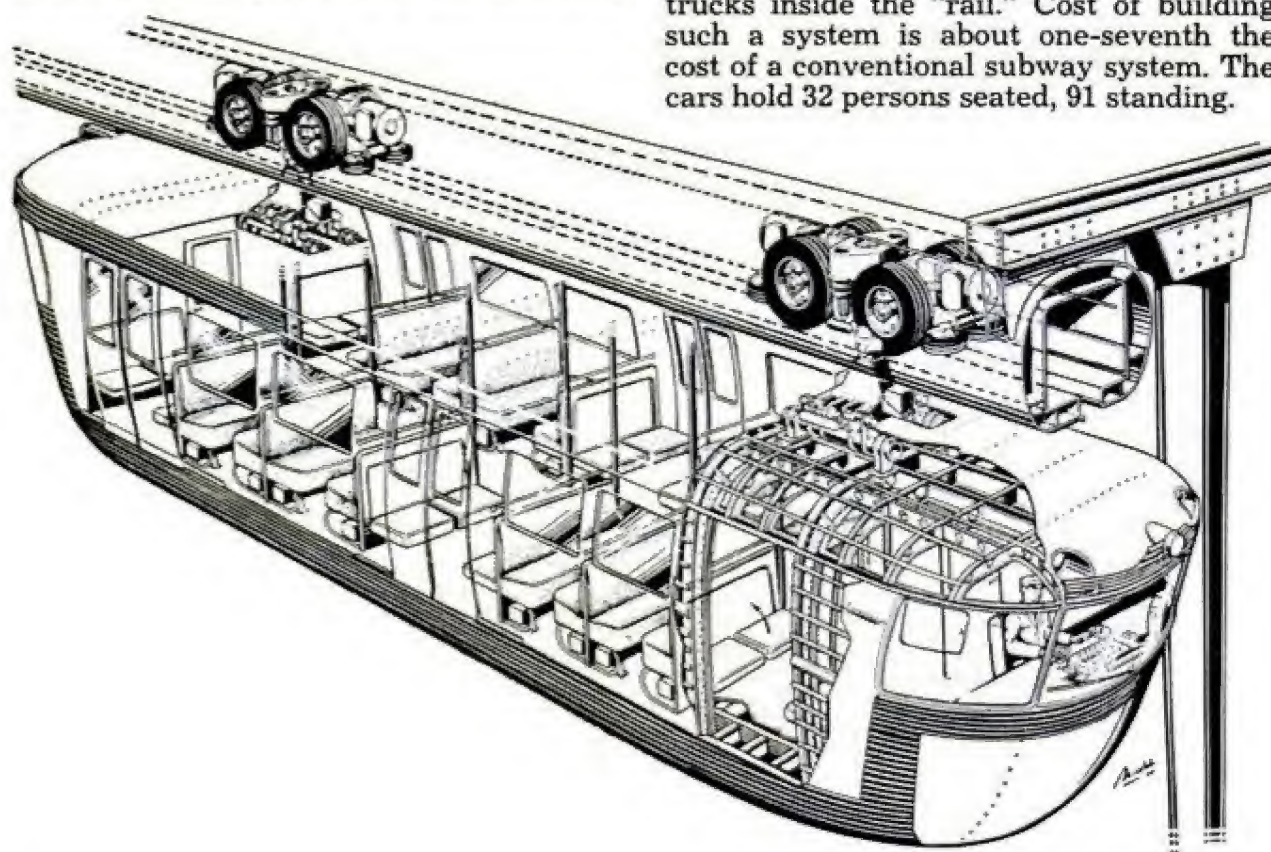




French Monorail Train Rolls Quietly on Pneumatic Tires

Fast, quiet and relatively inexpensive to build, a French monorail system of urban transportation may help solve the problem of mass transit. Built by Renault as a test program, the monorail operates on a demonstration track just over a half-mile long

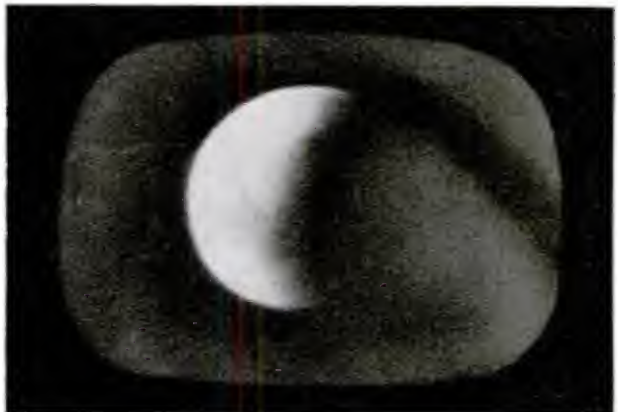
near Orleans, France. Operating speed of the electric-powered car is about 60 miles per hour. Eight pneumatic-tired wheels carry the weight of the car, rolling quietly inside a box girder. Eight smaller wheels are mounted horizontally to position the trucks inside the "rail." Cost of building such a system is about one-seventh the cost of a conventional subway system. The cars hold 32 persons seated, 91 standing.





Eclipse Televised Through Binoculars

Enterprising cameraman Ed Cushman, of television station WFRV in Green Bay, Wis., trained his camera on the moon and televised the phases of an eclipse. He shot through a pair of 20 by 50 binoculars. The eclipse occurred during Saturday night and Sunday morning, March 12 and 13, and the telecast covered the major part of the 1½-hour display. This is thought to be the first live telecast of a moon eclipse.



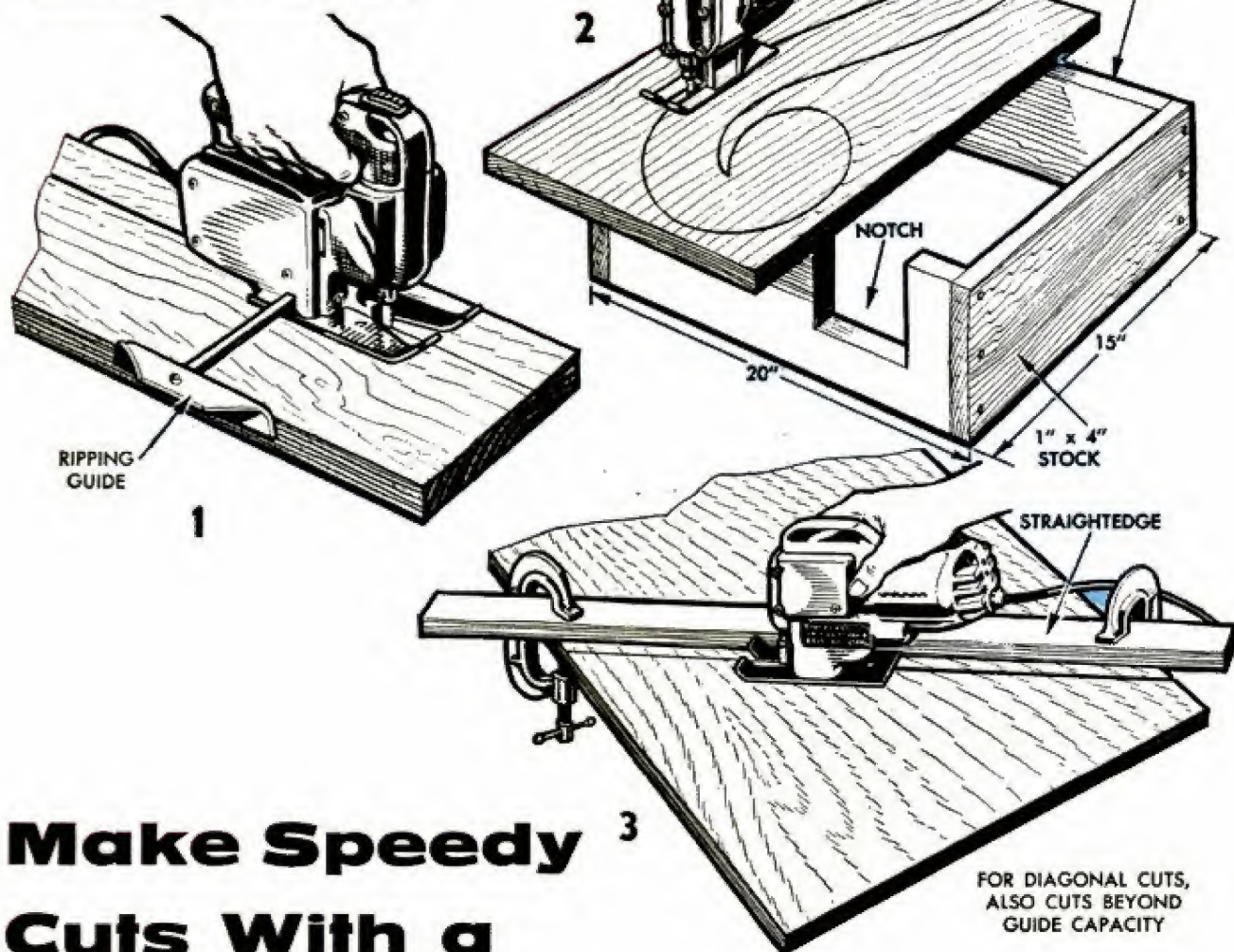
"Stained-Glass" Window With Blocks

Architect Richard Hapke gave a stained-glass effect to Grace Evangelical Lutheran Church, in Peoria, Ill., but at a much lower cost than the real material. He employed a new construction material called Color Glass Blocks which also gives the translucent areas of the church the insulation qualities of an eight-inch masonry wall. The new material has a translucent, fired-on ceramic finish that resists scratches and abrasions. Its manufacturer, Pittsburgh Corning Corp., says the finish resists industrial atmospheres and that long exposure to sunlight causes no significant fading. Hapke employed some 4000 red, blue, yellow, green, black and white blocks on back and front walls of the church. The blocks continue down to grade level.

☛ Repairs to California highways are being made with epoxy resins so strong they hold even when the concrete itself breaks.



SHOP NOTES AND CRAFTS



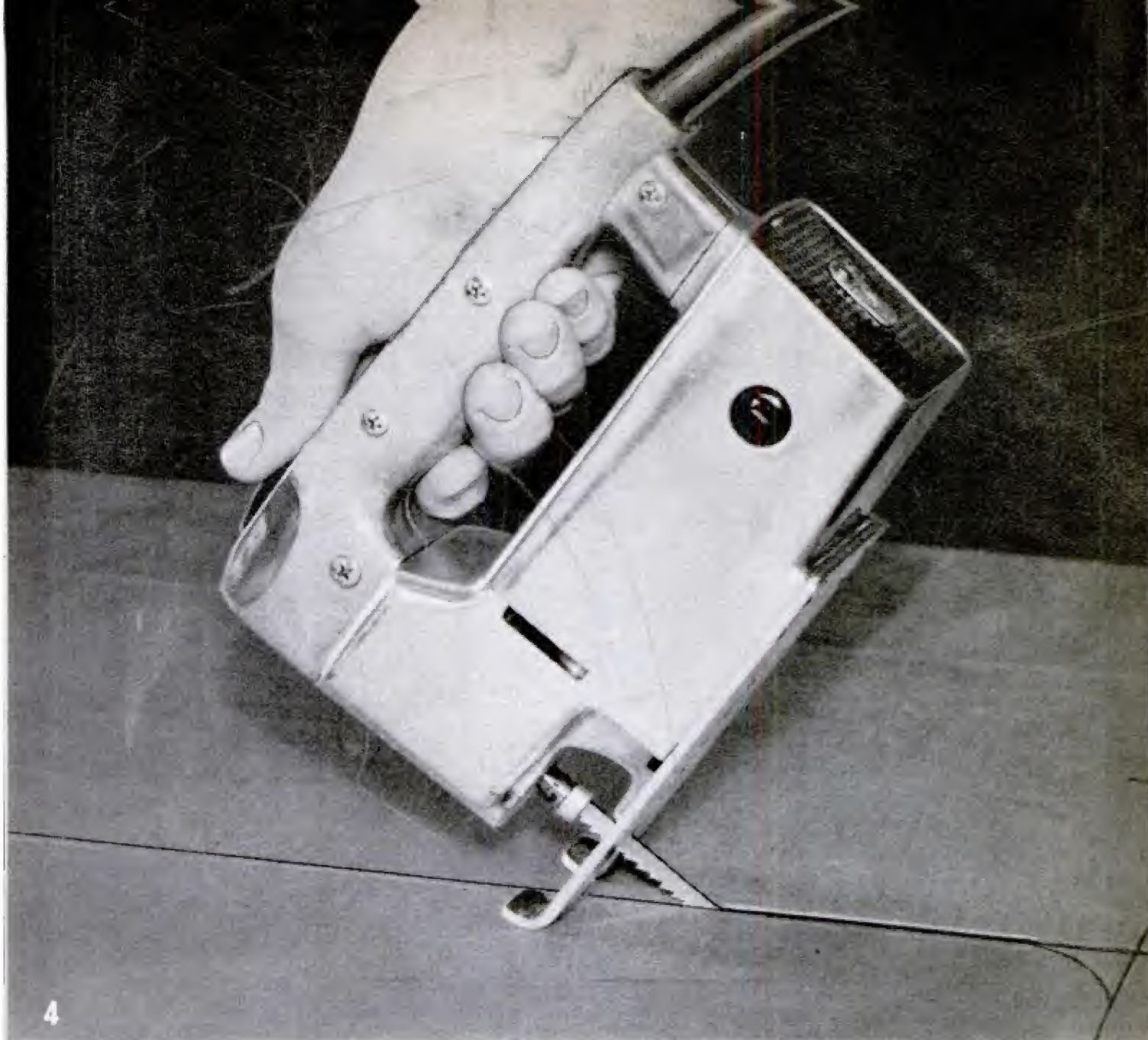
Make Speedy ³ Cuts With a PORTABLE SABER SAW

By E. R. Haan

LIGHTWEIGHT and easy to handle, a portable saber saw is an efficient handful of power having many applications in the home and shop. It will make straight and curved cuts in wood, hardboard, plastic and metals. It can do almost any job for which a stationary jigsaw or small band-saw ordinarily is used. Also it can take on some jobs these power tools can't handle such as plunge cuts and inside and outside cuts on large panels which cannot be worked on conventional jigsaws or band-saws because of the limited throat clearance of these machines. No other electrical tools combine the convenience and ability of the saber saw for cutting small openings of almost any shape in walls, floors and cabinet tops for the installation of outlet boxes, conduit and plumbing.

On some saber saws the shoe, or sole, plate is pivoted as shown in Fig. 5, which permits cutting at various angles, usually up to 45 deg. in two directions. While portability is one of their outstanding features, saber saws also can be mounted in an inverted, fixed position on an accessory stand which usually is provided with a miter gauge and a ripping fence. Such a stand is useful when work requires fine accuracy.

Due to the projection of the blade below the sole plate of the saber saw, adequate clearance must be provided under the stock being cut. Small work can be mounted vertically in a vise or it can be held horizontally on an improvised supporting frame which provides clearance above a workbench or table, Fig. 2. Plywood panels usually can be adequately supported on sawhorses.



PLUNGE CUTTING, which is making an inside cut without a starting hole, can be done with portable saber saw

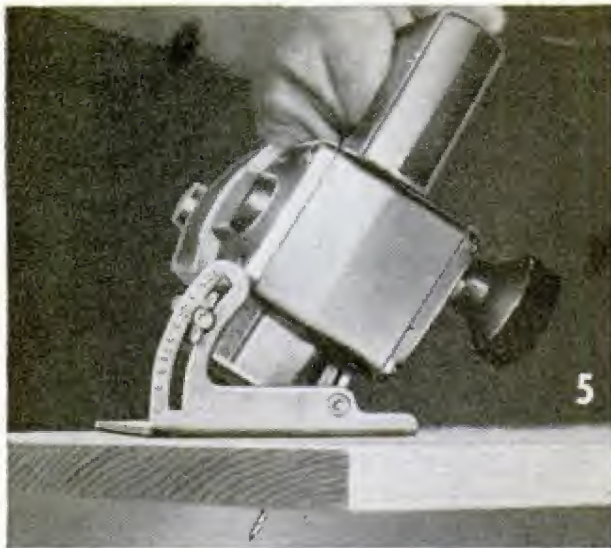
Many saber saws are provided with an adjustable ripping guide, or fence, which aids in making cuts parallel to the edges of stock, Fig. 1. When a straight cut is made beyond the limits of the ripping guide, or the cut is not parallel to an edge, the saw is run along a straightedge clamped to the work as in Fig. 3.

Letting the blade cut into wood, plaster or other soft material to make an internal cut is referred to as plunge cutting. To do this you rest the front edge of the sole plate on the work surface as in Fig. 4 so that the moving blade comes directly over the cutting line, or in the waste as the work requires. Then, using the sole plate as a fulcrum, you gradually lower the blade into the work. It will cut through $\frac{3}{4}$ -in. wood in a few seconds. As soon as the saw has been lowered to its normal operating position you proceed with cutting.

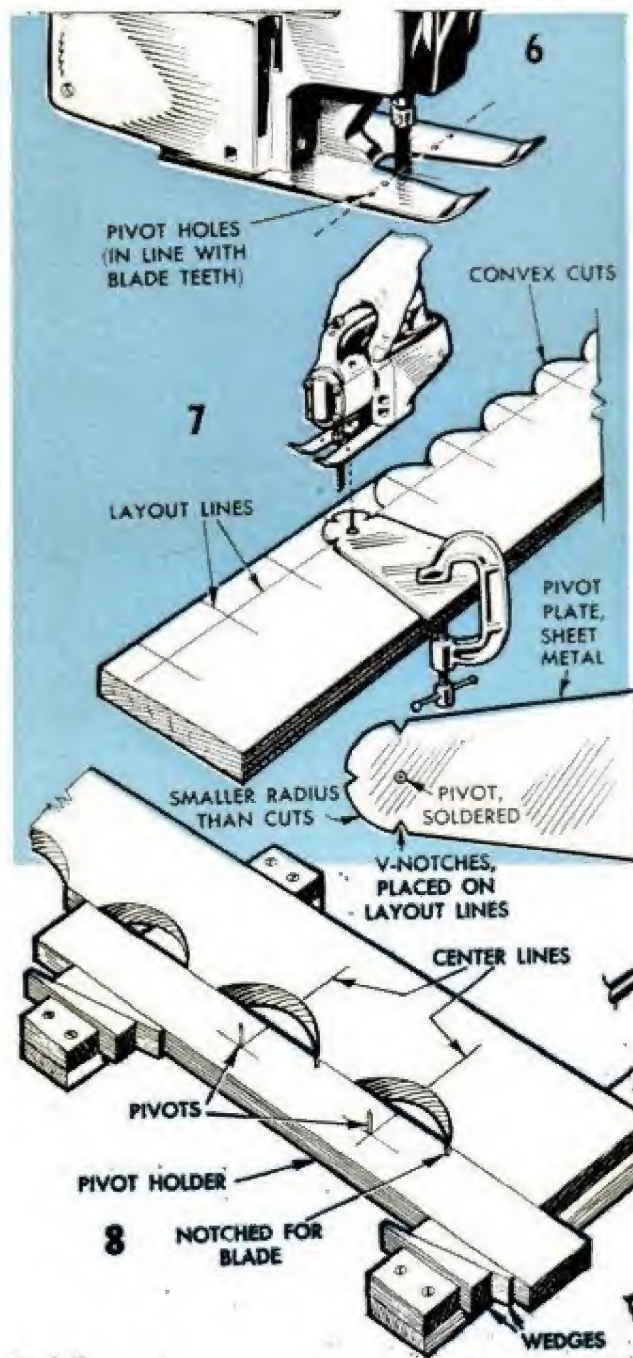
A circle-cutting attachment usually is

available for saber saws as an accessory. The pivot point of the circle-cutting jig must be in alignment with the cutting edge of the blade so that the teeth are located at the intersection of a radial line and the circumference of the circle. On some saws the accessory ripping guide can be used, Fig. 10. The pivot point is located for a blade of certain width, or gauge. A blade of different width will not be in perfect alignment and will tend to lead in or out of a true circular path. Make sure that the pivot point is correctly located before cutting stock.

For small-radius work, pivot holes may be drilled in the sole plate in line with the cutting edge as in Fig. 6. Pivot pins, usually brads, should fit these holes exactly since any play may cause waviness in the circular cut. In producing decorative edges with arcs and half circles, as for example scalloped window valances, a saber saw can be pivoted as shown in Figs. 7 and 8.



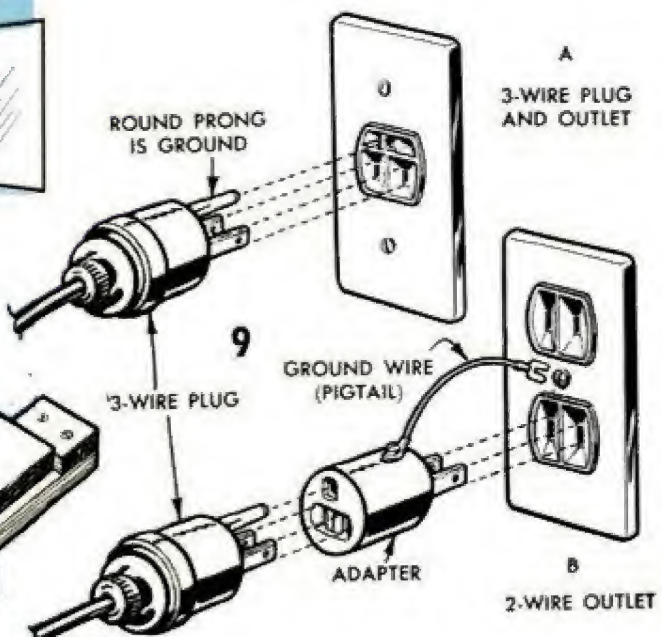
MANY SABER SAWS can be tilted from 0 to 45 deg. for making cuts at an angle. Note graduated quadrant

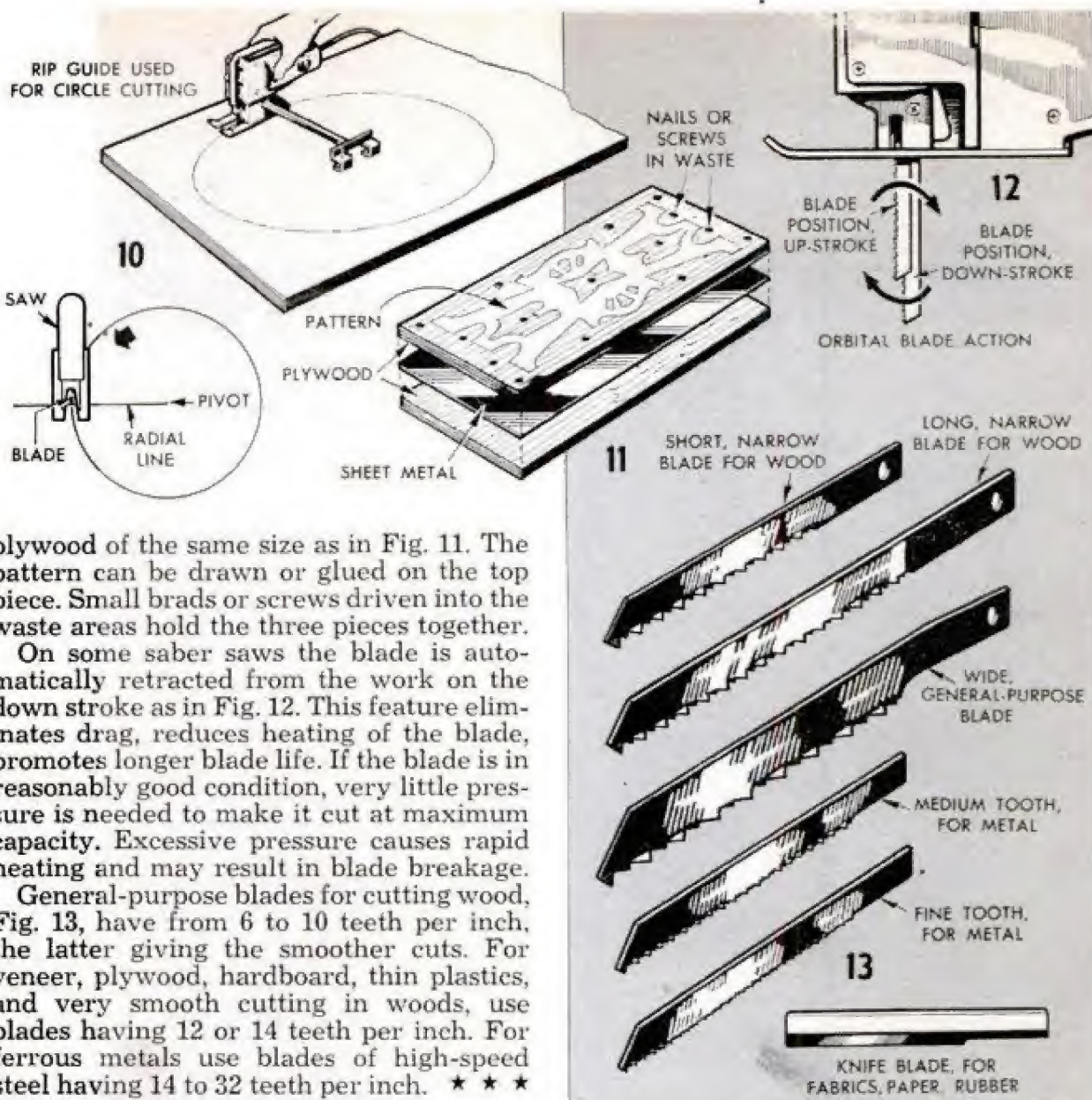


Movable pivot holders can be clamped on the surface of the work as in Fig. 7 where it is not desired to mar the work with holes made with brads. In this case a sheet-metal plate to which a brad is soldered is clamped onto the work, Fig. 7, so that the three notches coincide with right-angle layout lines. This automatically centers the pivot brad. The radius at the end of the plate should be smaller than that of the semi-circle to be cut. Fig. 8 shows a pivot-pin holder that can be adjusted to any position along the edge of the work in which concave cuts are to be made. After lining up the pivot pins with previously marked center lines on the work, the holder is clamped in position with wedges.

In nearly all types of work saber saws are held in the hand while in operation and for this reason they should always be grounded to prevent accidental shocks to the operator. For this purpose saber saws generally are provided with 3-wire cords, the third wire being a ground wire. Connection is made either to a matching 3-wire outlet box, Fig. 9, detail A, which is already grounded to the electrical system, or to a 3-wire adaptor that fits into a 2-wire outlet as shown in detail B. The wire extending from the adaptor is fastened to the metal screw that holds the plate or cover.

Always use metal-cutting blades, preferably with wave-set teeth, for sheet metal and thin-wall tubing. Clamp light sheet metal firmly so that cutting takes place as closely as possible to the points of support. Make turns slowly to prevent blades from bending or breaking. To avoid objectionable burring and possibly tearing along edges of thin sheet metal, clamp it firmly between two flat pieces of hardboard or





plywood of the same size as in Fig. 11. The pattern can be drawn or glued on the top piece. Small brads or screws driven into the waste areas hold the three pieces together.

On some saber saws the blade is automatically retracted from the work on the down stroke as in Fig. 12. This feature eliminates drag, reduces heating of the blade, promotes longer blade life. If the blade is in reasonably good condition, very little pressure is needed to make it cut at maximum capacity. Excessive pressure causes rapid heating and may result in blade breakage.

General-purpose blades for cutting wood, Fig. 13, have from 6 to 10 teeth per inch, the latter giving the smoother cuts. For veneer, plywood, hardboard, thin plastics, and very smooth cutting in woods, use blades having 12 or 14 teeth per inch. For ferrous metals use blades of high-speed steel having 14 to 32 teeth per inch. ★ ★ ★

GENERAL SPECIFICATIONS OF PORTABLE SABER SAWS (all dimensions in inches)

| TRADE NAME, MAKER & CAT. NO. | CUTTING CAPACITY | STROKE LENGTH | STROKES PER. MIN. | WEIGHT (Lbs.) | OVERALL DIMENSIONS | | | BEARINGS | ADJUSTABLE FOOT |
|--|----------------------------|---------------|-------------------|---------------|--------------------|-------|--------|---|-----------------|
| | | | | | LENGTH | WIDTH | HEIGHT | | |
| Black & Decker Mfg. Co. U-10 | 1½ Softwd. 1 Hdw. | ½ | 3750 | 3½ | 8 | | | Ball bearings in motor and needle bearings in gear case | |
| "Craftsman" 2798 Sears Roebuck & Co. | 2½ Wood | 1 | 2700 | 6½ | 8 | 2¾ | 8¾ | | |
| "Disston" D-23 H. X. Porter Co. Inc. | 2½ Wd., ½ Alum. ¾ Steel | | 3800 | 5¼ | | | | 3 ball and 9 needle bearings | |
| Cummins Portable Power Tool Co., Div. John Oster Mfg. Co. 466 | 2 | ½ | 3500 | 5 | 6¼ | | | Ball and Sintered Bronze | |
| "Dyna-Mite" 480 Millers Falls Co. | 1¾ Wd. ¾ Metal | ½ | 3000 | 3½ | 7½ | | 6 | | |
| Porter-Cable Machine Co. 152 | 1¾ Wd., ¼ Alum. ¾ Steel | | 4700 | 5 | 7 | 4½ | 7 | Self-lubricating bronze | Accessory foot |
| "Powr-Kraft" 8930 Montgomery-Ward Co. | 2 Wd. | ¾ | 2650 | 4 | | | | | |
| Skil Corp. 514 | 2 Softwd. 1½ Hardwd. | | 4000 | 3¼ | 9 | | | Ball thrust and cushion-mounted sleeve bearings | |
| Stanley Electric Tools H-75 | 2 Wd. | ¾ | 3300 | 4¼ | | | | | |
| Sunbeam Corp. 76 | 1¾ Wd. | ¾ | 1780 | 3¼ | 7 | 2½ | 3½ | Ball and needle | |
| Thor Power Tool Co. 440 | 1¾ Wd. ¾ Steel | ½ | 3400 | 4 | 6¾ | | 7 | Oilite | |
| Weller Electric Corp. 800 | 1 Wd. | | | | | | | | |
| Wen Products, Inc. 505 | 1¾ Wd. ¾ Steel | ¾ | 2650 | 3½ | 6¾ | | 5 | | |
| Portable Electric Tools, Inc., "Shopmate" | 2 | ¾ | 3050 | 4 | 7½ | | 5 | Needle and Bronze | |

Hints To



1



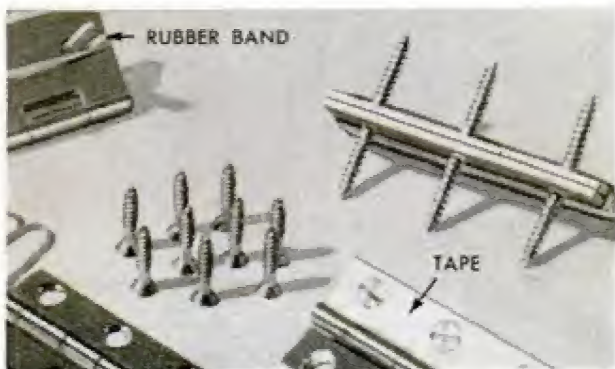
2



3



4



5

1. Household chores can be mighty hard on a lady's hands, especially those involving the use of a bucket with a wire handle. However, a length of rubber hose slipped over the handle offers good protection and provides an excellent grip at the same time.

2. No need to guess how much paint there is left in those cans when it is so easy to keep track. After using the can, place a rubber band around it at the level of the remaining paint and you'll know at a glance.

3. Inserting a number of screw eyes is no problem if you make things easy for yourself with this simple driver. It involves no more than cutting a slot in the end of a piece of broomstick just wide enough to receive the head of the screw eye. A small piece of wood may be wedged in the slot to accommodate screw eyes of smaller size.

4. Why let rubber stamps get tossed around in a drawer when you know such treatment will eventually ruin them? If you have spring-type clothespins around the house, tack several of these along the edge of the desk or worktable. They will keep the stamps clean and readily available for use and if desired, may be painted to suit.

5. Got a handful of hinges and no screws? Next time find a way to keep them together before you store them. Quickest and easiest way is to insert the screws in the holes, close the hinge, and wrap it with tape or with a large rubber band until needed.

Remember

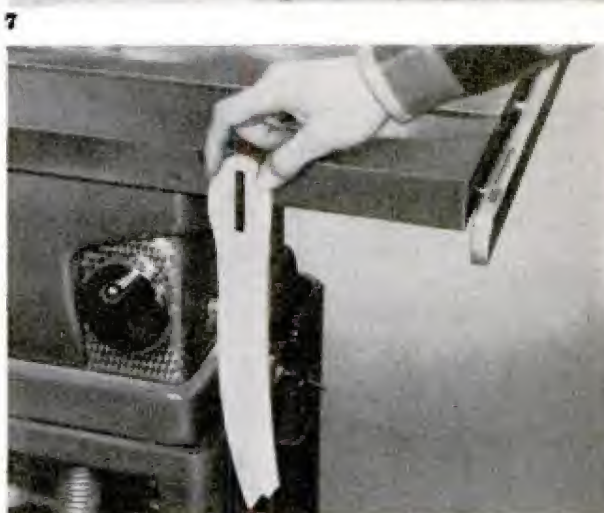
6. Garden enthusiasts—don't throw away those plastic vegetable bags. They are the ideal thing for protecting sprouts and seedlings through the fall and early spring chills and also are much easier to store than glass jars kept for the same purpose.



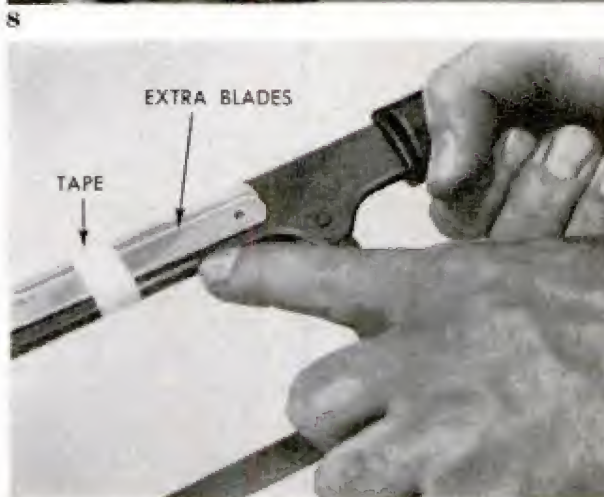
7. Here's another one for you backyard farmers. A series of notches filed along one edge of your trowel will help to quickly determine when you have reached the proper depth in inches at which to plant seeds.



8. Wondering where to put that push stick you use on the circular saw? It is bound to get lost if left lying around, so place a small permanent magnet near the top of the stick. Now you can put the push stick anywhere along the sides of the saw cabinet or table and know that you can find it whenever needed to safeguard the fingers.



9. One of the best places to store those extra hacksaw blades you always need and can't find is right on the saw itself. Then if you can find the saw you have the blades. Tape several blades of different sizes to the top member of the saw frame as pictured. They won't interfere with use of the tool.





View Finder Sheds New Light

If the reflected white frame of a photographic view finder is hard to see in dim light, the situation can be remedied by coating the frame with phosphorescent paint. The paint can then be charged by holding the view finder near a lighted lamp.

—W. E. Burton



Eye-Dropper Bulb Steadies Reels

Cure your tape-recorder reels of wobble and backlash by slipping the rubber suction bulb of a discarded eye dropper over each spindle. All play, record and rewind operations will run smoothly even with the recorder in a vertical position.

—W. A. Crane



Lacquer Clears Holes In Plastic

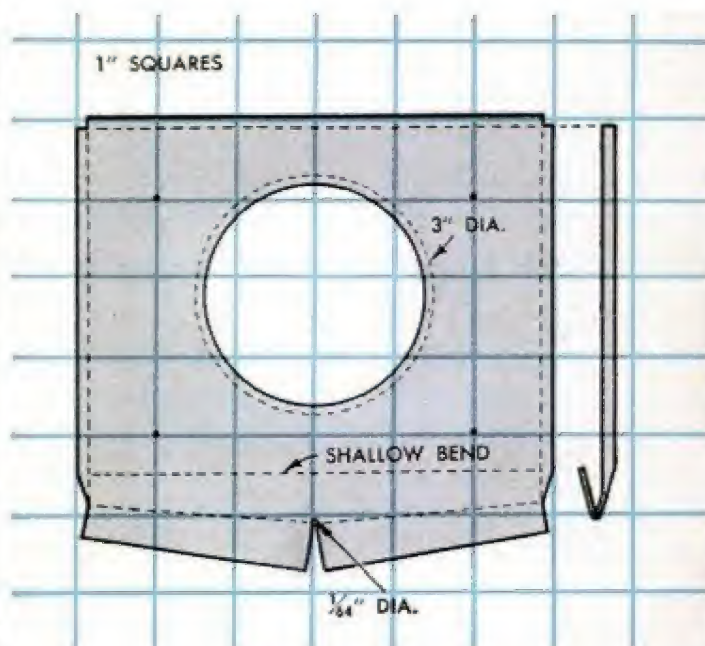
Holes drilled in transparent plastic usually have a frosty appearance which, for one reason or another, you may find objectionable. In this case, most of the frosty appearance can be eliminated by coating the holes with clear lacquer.

UNDER-WINDOW

By John Jefchak

OUTSIDE IT'S ZERO. Inside it's warm as toast but stuffy. You raise the window and open the storm sash. What happens? You get relief with the fresh air but the windows start to sweat and frost over. The cold air causes condensation to form on the glass. By morning you will be mopping water and chipping ice off the window stool. Come spring you'll be repairing checked paint and refinishing watersoaked wood. You're apt to feel you just can't win.

But you can by installing through-the-wall window defrosters. These neat little air inlets, which are located under windows, solve the window-sweat and fresh-air problem once and for all. When you want some fresh air in the room you simply open the defroster instead of the storm window. And since driving snow or rain cannot enter, the units can be used the year round. Each defroster is made of sheet aluminum and a length of 3-in. drain pipe. The room end of the pipe is capped with a $\frac{1}{8}$ -in. hardboard collar $5\frac{3}{4}$ -in. square which has a 3-in. hole centered $2\frac{1}{4}$ in. down from the top. The hardboard is faced with sheet aluminum which is cut according to the pattern given below. Note that the hole is made smaller than the hole in the hardboard, and that the lower edge of the metal is bent upward to form a drip trough to catch the small amount of condensation that forms on the metal. A little cleansing tissue placed in the trough will absorb what little moisture collects. The aluminum facing is peened down over

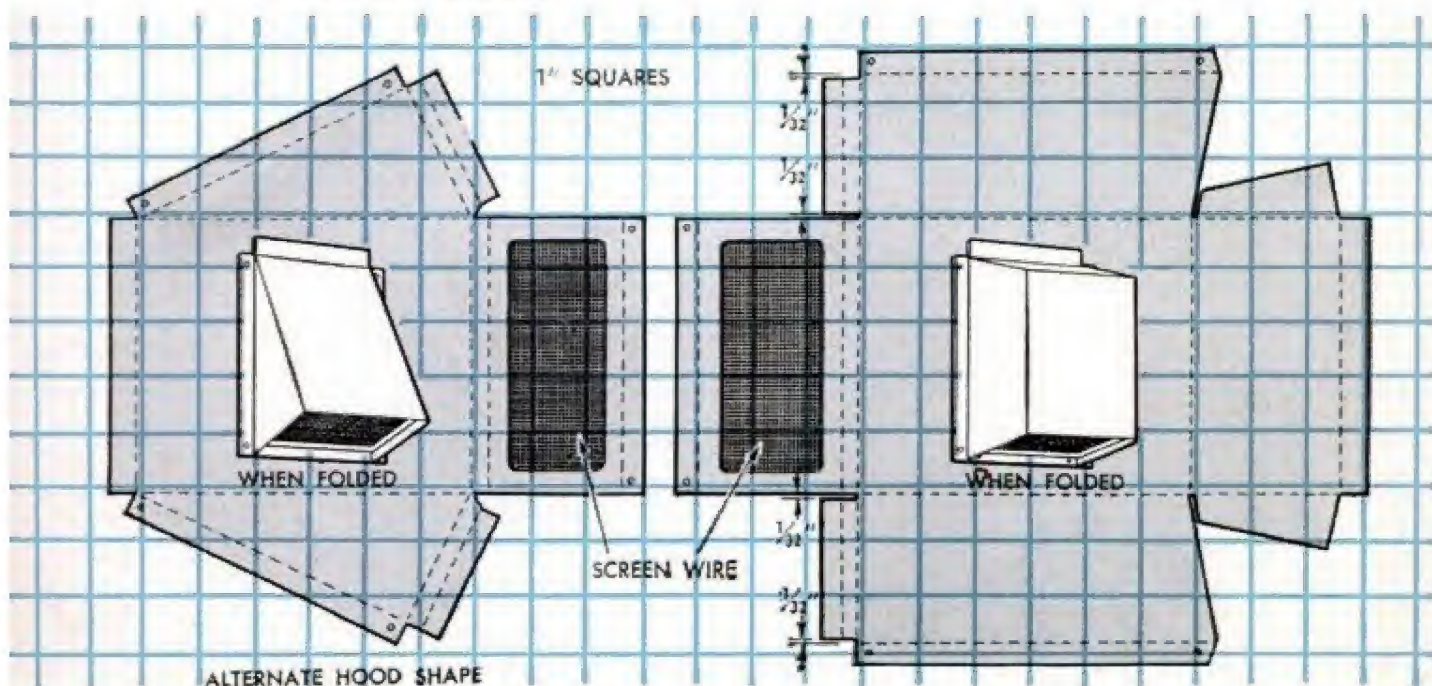
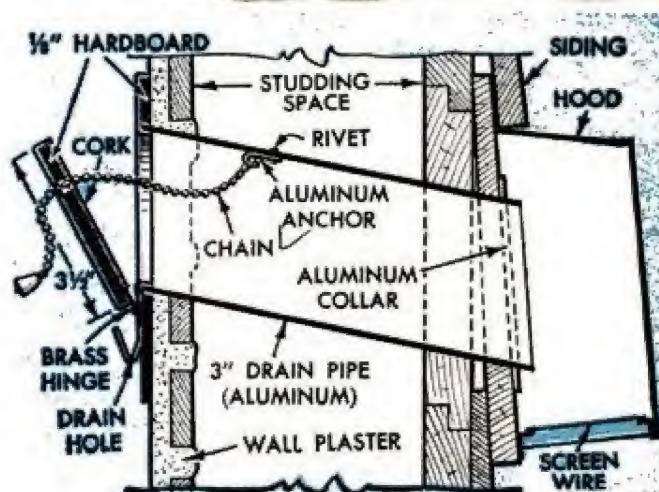


"DEFROSTER"



three edges of the hardboard, including the hole. Peening around the hole is done with the angle-cut drain pipe in place and then four small angle brackets are added to join the hardboard collar to the drain pipe. Holes for these are made in both the collar and pipe for short aluminum rivets. The circular cover, or door, for the defroster is a $3\frac{1}{2}$ -in. disk of hardboard covered with sheet aluminum and is hinged with a small brass hinge. A beaded chain taken from a pull-chain socket provides adjustment for controlling the amount of air entering the room. The chain is attached to the pipe on the inside.

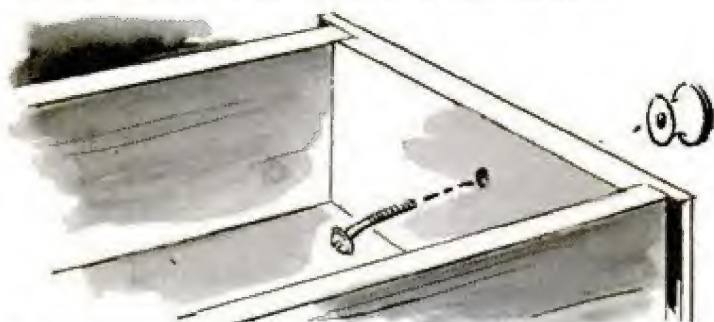
Cut the hole through the lath and plaster
(Continued to page 228)



SOLVING HOME PROBLEMS



STAND FOR HOLDING typing copy, instructions, recipes and the like is made from a coat hanger and spring-type paper clamp. Remove hook from top of the hanger and bend hanger ends forward, as shown



WHY BOTHER with a drawer knob that keeps coming loose when there's an easy way to tighten it permanently. Remove the screw and bend it slightly as in the detail. The bend prevents the knob from turning

SMALL FRY TAKE GREAT PRIDE in hanging their own clothes if the clothes rod is brought down to their size. A length of pipe is suspended from the regular rod by two hardwood hangers and ends are capped



PRIZED FIGURINES and small art objects are given their own individual display cases by placing them in clear-plastic gift boxes. Decorate the paper base of the box, adding suitable background cut from magazine illustration if desired. Place the figurine in the center and top it with the plastic cover



INDELIBLE STAINS on clothing may be set so thoroughly by ordinary laundering methods that you cannot remove them. Before laundering, wet stains with lighter fluid and then blot repeatedly until all of the pigment is removed



YOU'RE TAKING A PHONE MESSAGE and there's no pencil handy—that's the usual story. It won't happen if you wrap a rubber band around the receiver and slip a pencil under it





LOST YOUR PASTE BRUSH? What you need is a permanent holder. Bend one end of a paper clip outward, as shown, and tape the clip to the side of the jar. The projecting end makes an ideal holder over which to slip the hollow brush handle

PICNIC MEALS call for salt and finding a container is no problem if you hang onto an empty spice box. The kind with the sliding metal top is ideal since it is lightweight, leakproof and unbreakable



MR. HANDYMAN, if you're saving a can for keeping paint brushes in solvent or oil, don't cut the top entirely out. Leave a half inch or so to serve as a hinge, lift and bend the top, and snip a slot in it to hold the brush handle so bristles clear bottom of can



CRAFTSMEN lacking sufficient storage space in a basement can make good use of the floor joists. Center a wide board on the edge of each joist, fasten with screws and you have a pair of shelves for storing those small parts and miscellaneous items

BROKEN SAFETY STRAPS on the highchair can be replaced using an old garter. Cut the hard-rubber disk from one end of the garter and nail it to the bottom of the chair. Slip the metal buckle over this and nail the other end of the belt to the tray





Shovel Makes Useful Trowel

Need a convenient trowel for those small patching jobs in concrete walks and foundation walls? A fire shovel makes a good substitute. The shovel also is handy for placing small amounts of concrete directly in holes. Afterwards shovel can be easily cleaned under a faucet.

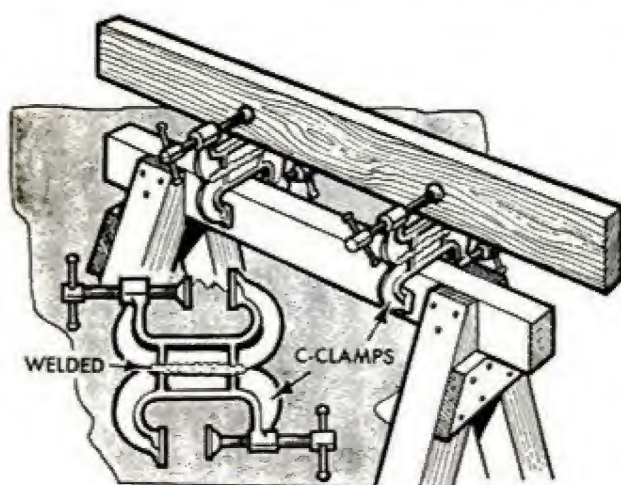
—G. E. Hendrickson

When boring a deep hole in hardwood or soft metal, be sure to clean out the hole at frequent intervals to clear the bit.

Substitute Marking Gauge

This improvised marking gauge is made by fitting a pulley to a piece of metal rod. A thumbscrew is substituted for the pulley setscrew so that adjustments can be made quickly. A $\frac{1}{16}$ -in. hole drilled through the end of the rod receives the marking pin. The pin is held in place with a short screw in a tapped hole at the end of the shaft. Both ends of the marking pin are pointed so that the pin can be used either way.

—H. Hanscom



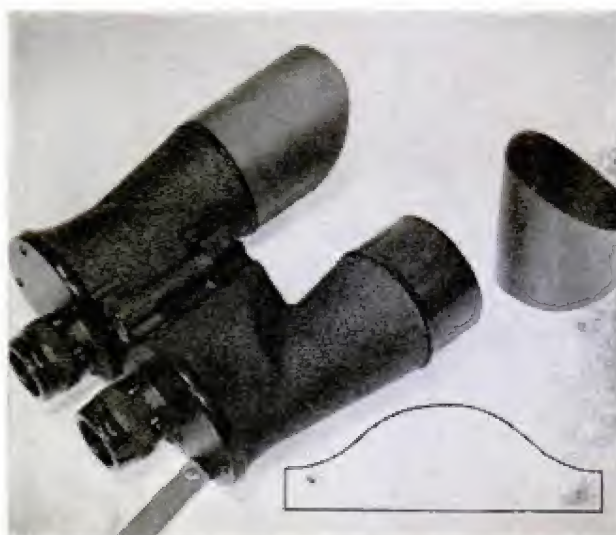
C-Clamps Used as Wood Vise

When away from the workshop, boards to be planed can be held in a vise made from 4 or 5-in. C-clamps mounted on sawhorses. Weld the C-clamps together in pairs, back-to-back, and arrange the screws on opposite sides to avoid interference with each other while turning them. Clamp a pair on each end of the sawhorse. To use, place a board in the vise and clamp in upright position. The clamps can be kept handy, yet out of the way when not in use, by attaching them to the underside of the sawhorse rail.—William B. Eagan

Sunshades for Binoculars

Direct sunlight can be shielded from the lenses of binoculars with a set of shades made from an old inner tube. Cut out a cardboard pattern the size and shape desired, and make the pattern about $\frac{1}{4}$ " shorter than the circumference of the barrel. Then, when the ends are joined, the shade will fit snugly. Cement is used to fasten the pieces together. If the joints are lapped, allow extra length for the overlaps.

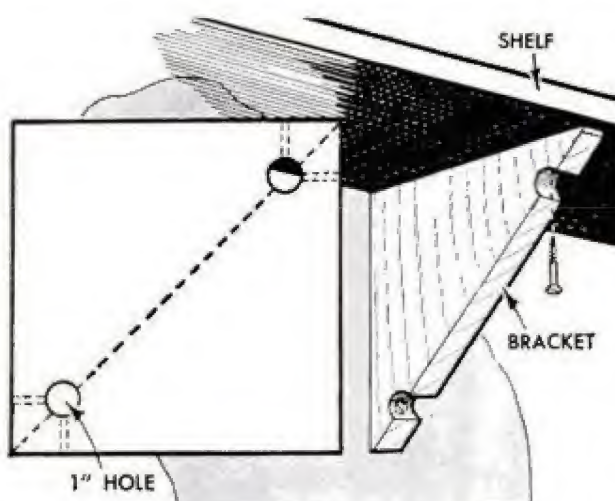
To save rubber gloves, turn them inside out and apply pieces of adhesive tape over each finger tip. The tape helps protect the gloves from sharp fingernails.



Fun Galore With a Whirligig

An amusing toy that children are sure to go for can be made from two forks, a cork and a nail. Thrust the forks into the cork at an angle that brings the center of gravity below the point of the nail. The cork and nail will be held in a vertical position at all times, regardless of whether the toy is spinning or motionless. By applying a twisting motion to the cork the toy is set spinning. This rotating motion will continue for a long time because there is almost a complete absence of friction.

—Bertram Brownold



Shelf Brackets From Scraps

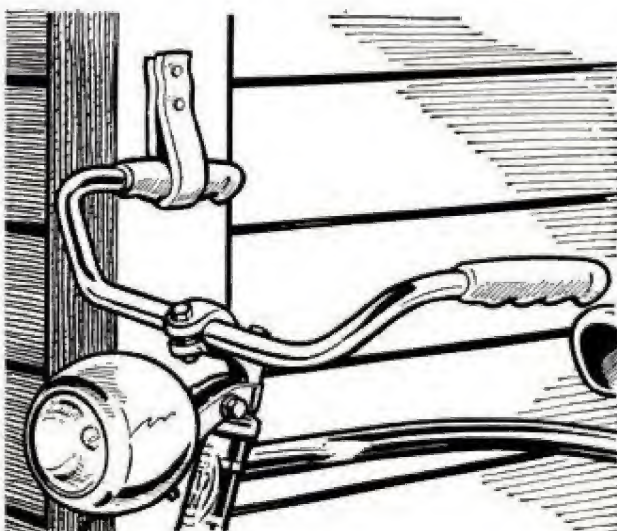
Sturdy shelf brackets can be made from squares of scrap lumber. Just be sure to square the pieces before drawing the diagonal line across each board. Bore 1-in. holes 2 in. from each corner to permit placement of screws as pictured. Saw each square on the diagonal line to make a pair of brackets. Screw holes are drilled in the edges of the brackets. The shelves are attached to the wall with screws through the predrilled holes. The brackets are made to extend almost the full width of the shelf.

—Joseph Federico

Improvised Glue Applicator

Don't discard those broken hacksaw blades. You can always find uses for them, such as spreading glue on a flat surface. Use a large spring paper clamp as a handle to hold a piece of hacksaw blade. The teeth of the blade allow glue to be applied in a smooth, uniform layer.—Bil Toman

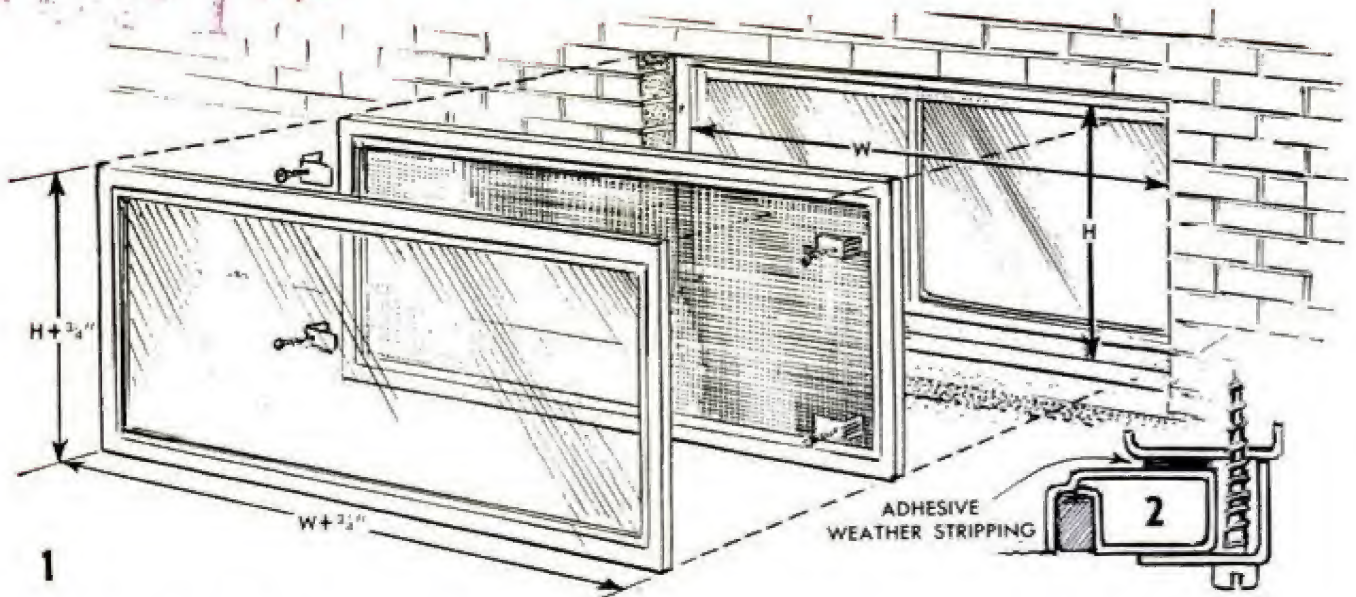
Your glass-topped coffee table or other furniture will become real conversation pieces if you slip some of those prized snapshots under the glass.



Strap Support for Bicycle

Bicycles have a habit of getting in the way around the garage or driveway. But if you nail a looped strap to the corner of the garage, inside or out, it insures a safe, upright location for parking a bicycle in an out-of-the-way spot. Place strap at a suitable height so that one of the handles can be inserted.

Waterproof capsules can be made for matches taken along on a fishing or camping trip by sealing the matches between two strips of cellophane tape. Using sulphur matches, seal one in each capsule.



Make All-Metal Screens and Storm Sashes

for basement windows. Frames are easily made with household tools from stock metal shapes available almost anywhere

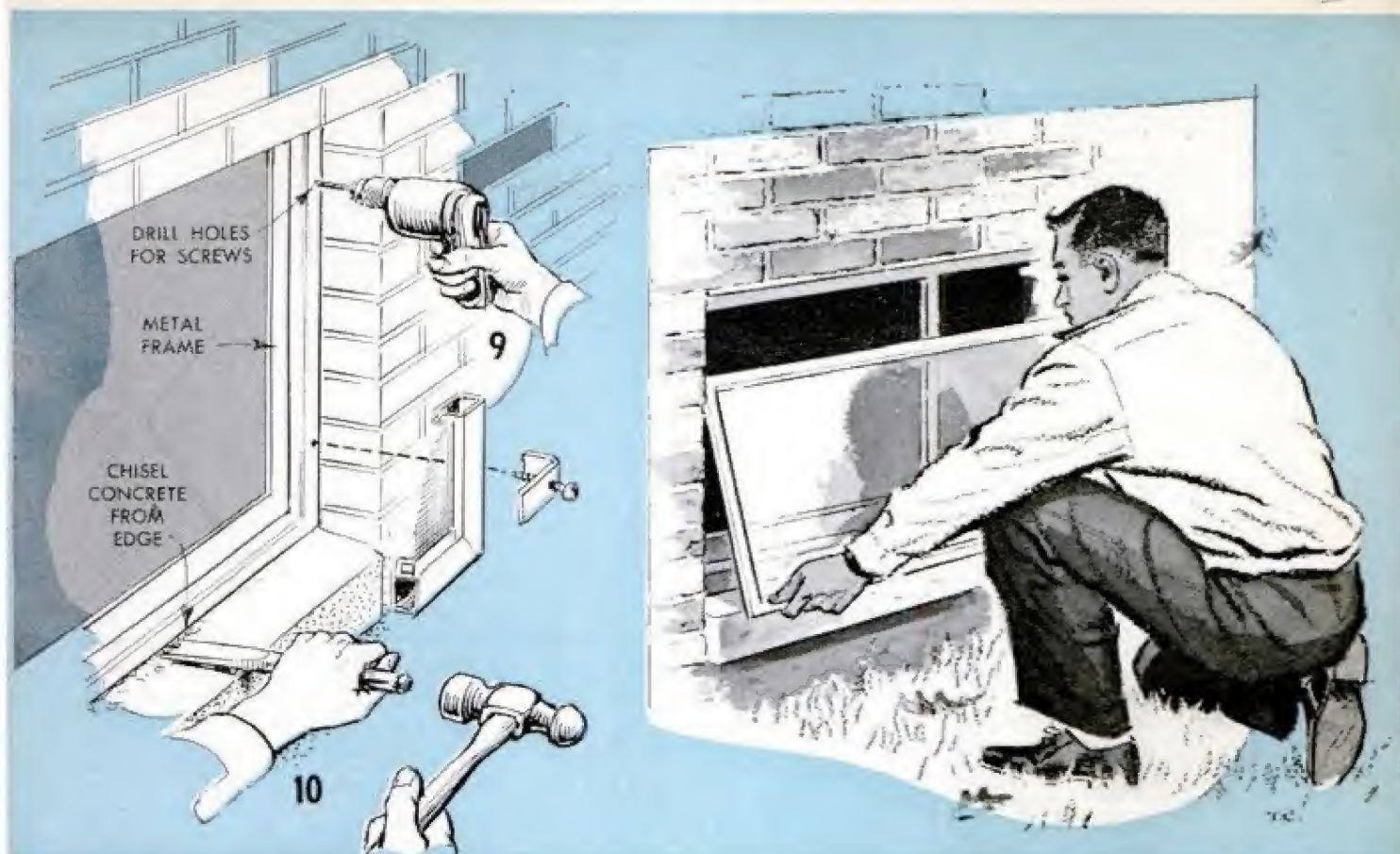
By Dave Swartwout



FRAMING PIECES can be sawed with woodworking tools such as fine-toothed hand saw or table saw. Corner locks are pushed into side pieces and tapped firmly in place with mallet. Then locks are "staked" to sides

STORM-WINDOW GLASS is sealed around edges by rubber glazing strip. And the corner locks are pushed into the metal channels so the glazing strip fits snugly between the glass and the metal channel of the frame





USING easy-to-work aluminum, it's a snap to make lasting screens and storm-sash frames for basement windows. Aluminum is easily worked with ordinary hand tools. The metal frames do not require painting and never need repair or other seasonal maintenance if carefully handled.

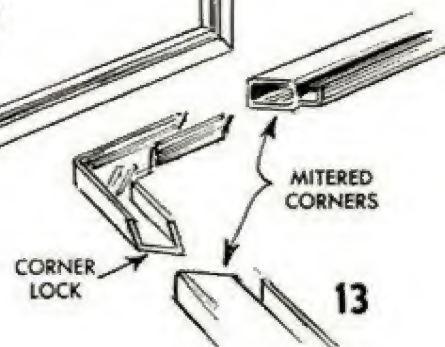
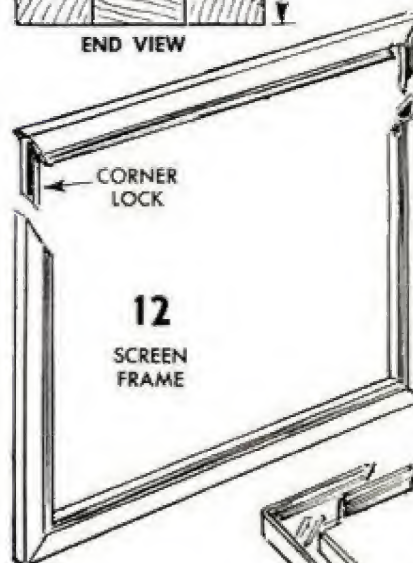
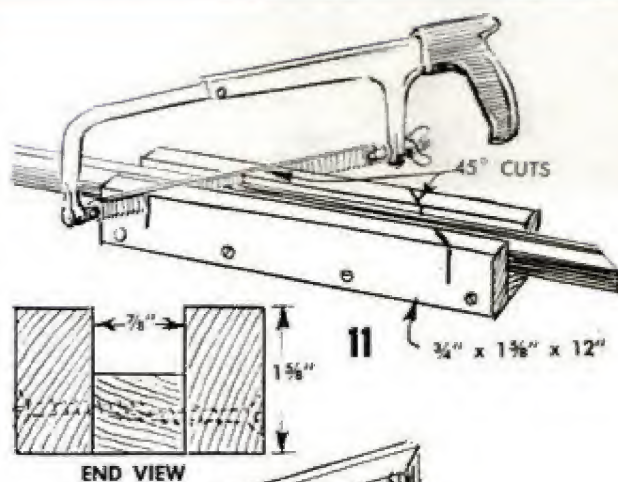
Window openings must first be measured accurately as shown in Fig. 1, and to these measurements add $\frac{3}{4}$ in. to the length of each piece, which allows an overlap of $\frac{3}{8}$ in. on all sides. You may find it necessary to change the overlap dimensions slightly.

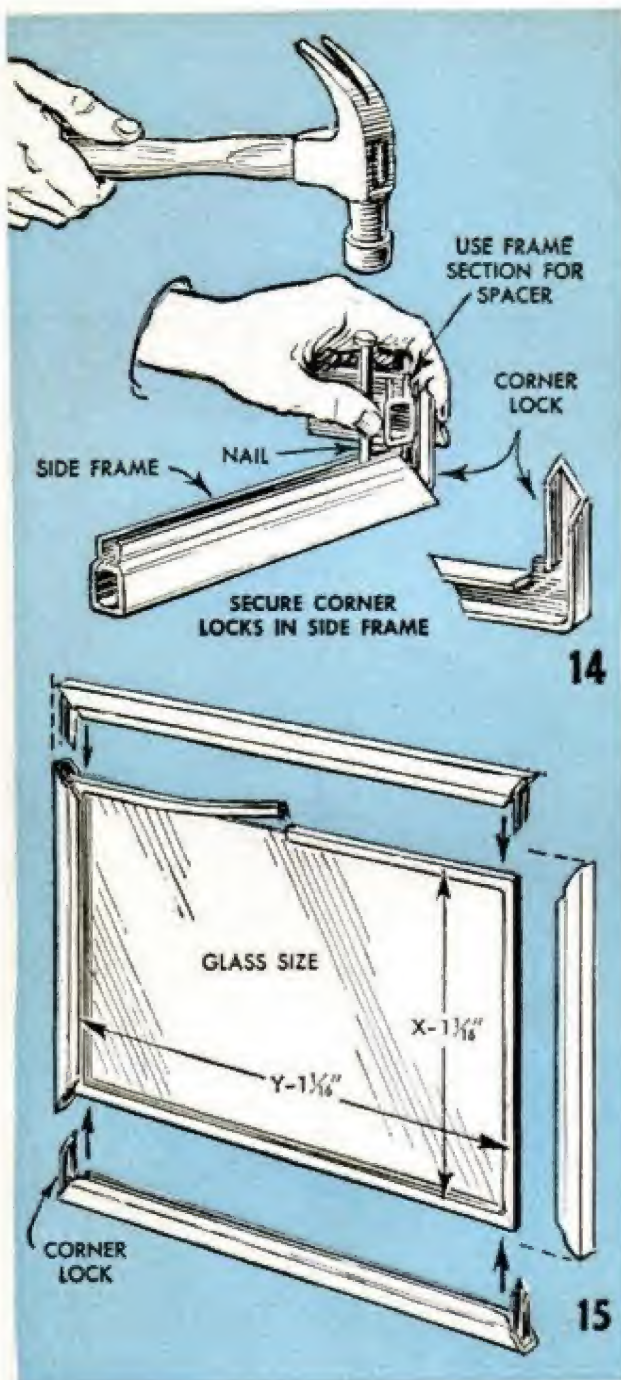
Framing members can be cut with a power saw, Fig. 3, or in a homemade miter box, Fig. 11, using a fine-toothed hacksaw or backsaw. When sawing a framing member to length, make sure the piece is held securely so that there is no chance for "creeping." File the cut ends with a mill file or smooth with garnet paper.

Making the Screens

After framing members have been cut to length, assemble them as shown in Figs. 12 and 13, using the proper corner locks. Push the corner locks into ends of framing members—a gentle tapping with a hammer seats them firmly. Check the corners of the frame with a carpenter's square before lining up the screen wire and cutting it to size.

Cut aluminum screening to the outside dimensions of the frame and align it with the outer edge of the groove, Fig. 16. If plastic screening is used, the job of cut-



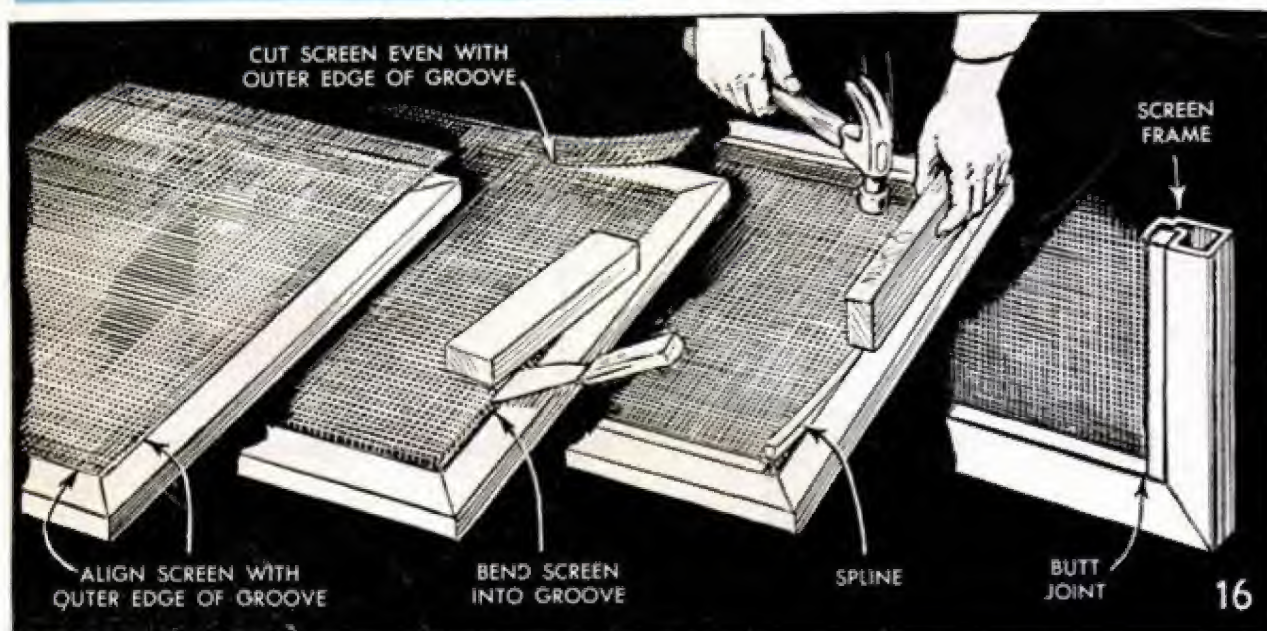


ting and assembling is simplified. An ordinary pair of scissors is satisfactory for cutting plastic screening. Trim away the excess material so screening lines up with the outside edges of the spline slots. Then bend the screening into the grooves with a putty knife and a block of wood. Then using a hammer and a suitable block of wood, tap the spline firmly into the groove along one of the long sides. Work around the frame forcing the screening into each groove and inserting the spline. Plastic screening can be tapped into grooves with a small strip of hardboard. Splines fit together at the corners with butt joints.

Making the Storms

The storm sashes are made the same size as the screen frames. Glass size is obtained by deducting 1 1/16 in. from the length and width of the frame, Fig. 15.

To assemble storm sash, insert corner locks into the long side pieces, Fig. 4. The small projection in the corner lock is staked to the side frame with a nail and hammer as shown in Figs. 5 and 14, locking the two pieces together. Glazing strips fit around edges of glass, Fig. 6. For ease in assembling, use short pieces of cellulose tape for holding strips to the glass. Cut triangular pieces from the corners of glazing channels to make neatly mitered corners. Now assemble the frame and glass as shown in Figs. 7 and 8. Adhesive weather stripping or a strip of rubber is cemented around the edges of the storm sash, between the sash and a metal casement, insuring a tight weather seal and avoiding metal to metal contact. For attaching frame to the window casing, use aluminum angles and screws, and fasten the angles to the casing as in Fig. 2, also Figs. 9 and 10, the latter showing the method of installing in a window opening in masonry. ★ ★ ★



S-T-R-E-T-C-H-Y TIE-DOWNS

By V. Lee Oertle

K EEPING boating gear snugged down, without constant attention to lines, is a simple matter when shock cord is used for this purpose as illustrated in this story. Made up of a bundle of small rubber strands sheathed in a woven cotton or nylon casing, this highly elastic cord may be stretched to nearly twice its normal length. Unlike manila or cotton rope, shock cord resumes its original length at the instant strain is removed. This characteristic is what makes it ideal for tie-downs.

Sold at marine-supply stores by the foot, shock cord comes in sizes ranging from $\frac{1}{8}$ to $\frac{3}{4}$ in. in diameter. Breaking strengths range from 30 to 1000 lbs. A frequently-used size, $\frac{1}{4}$ in., sells for about 20 cents per ft. While you can make any splice needed by using the materials and methods outlined in this story, patented fittings for making tie-downs also are available.

Since the work a tie-down must perform determines what size of cord should be used, selection of cord size is important. If your dealer cannot advise you on this, the manufacturer's table of rated breaking strengths (less about 40% allowance for safety) serves as a good guide. Match the weight of the object to be secured or restrained with the size-strength of cord, corrected for safety.

The value of shock cord is in the tension or pull it can apply when stretched. Therefore, the tie-down must be made shorter than the distance to be spanned. For normal tension requirements, one-fifth short of this distance is about right. When cutting cord to the length required for a job, allow sufficient length for the doubled portion of loops and eye splices. The latter are made fast with hog rings installed as shown in the photos. The addition of a tape binding, thimbles, steel rings and snap hooks strengthens the tie-downs and makes it easy to fasten and remove them quickly.

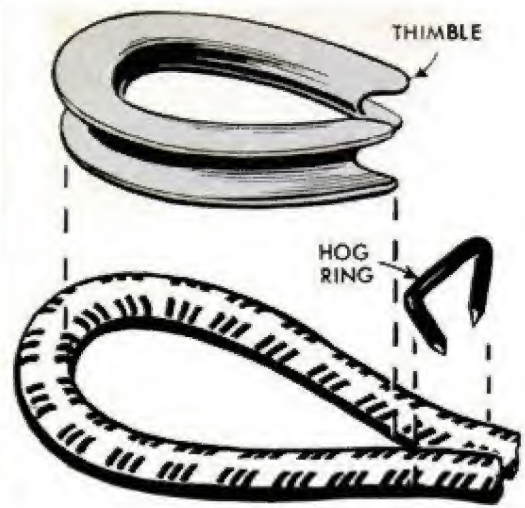
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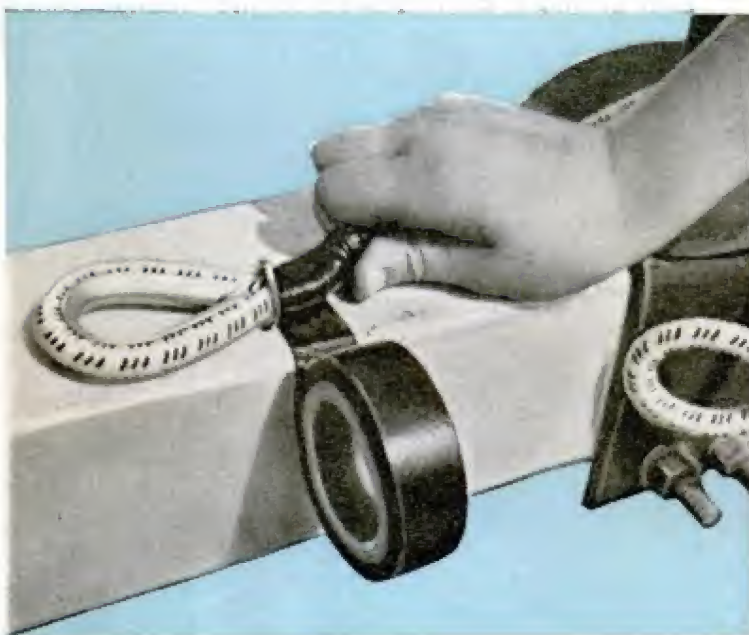
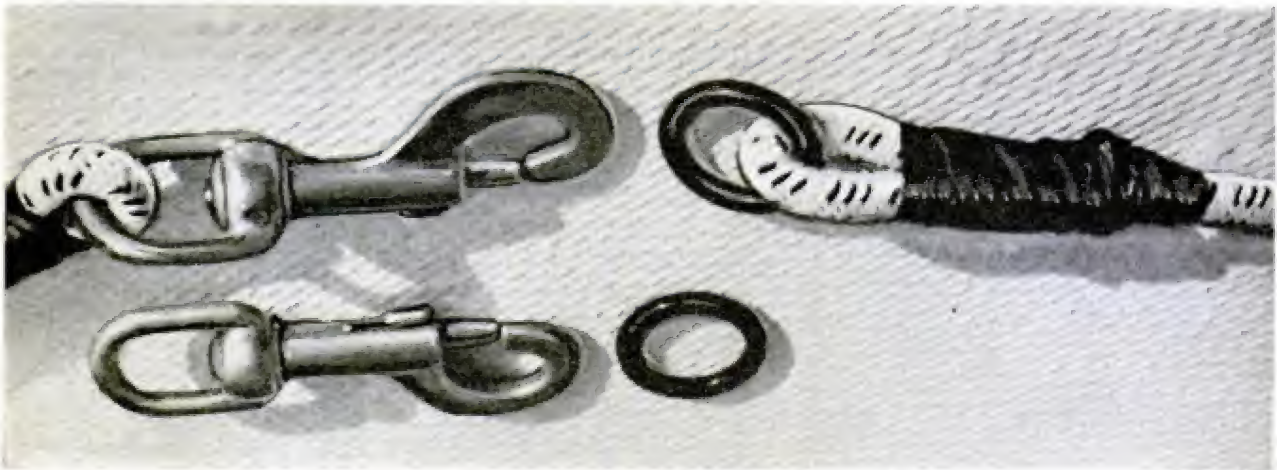
SHOCK CORD DOCK LINES with loops spliced on ends permit quick tie-ups for temporary stopovers. The cord won't chafe the boat's finish, saves tying knots, coiling and storing long, wet lines. By having a large loop at one end and smaller one at other end, ends may be reversed to suit the size of cleat, piling or other object on dock used as mooring bitt

TRAILING YOUR BOAT on a long trip? Shock cord can be used to snub boat to trailer at port and starb'd sides of stern, also at bow eye. Chain tie-downs are necessary for safety, of course, but the elastic cord provides sufficient tension to prevent the boat from rubbing or rocking on its support points





SPLICING EYES OR LOOPS on ends of shock cord is easy. One end of cord is folded back on itself to form loop of required size and fastened with two hog rings. Eye splices (small loops) that see hard use should be fitted with galvanized or stainless-steel thimbles as in the drawing above



SWIVEL-EYE SNAP HOOK is spliced on one end of cord, galvanized-steel ring on other end to make endless cord when snapped together. Used for special tie-down jobs, cord is cut to exact length needed to produce desired tension when outstretched and secured (make cord one-fifth shorter than distance spanned by unstretched cord)

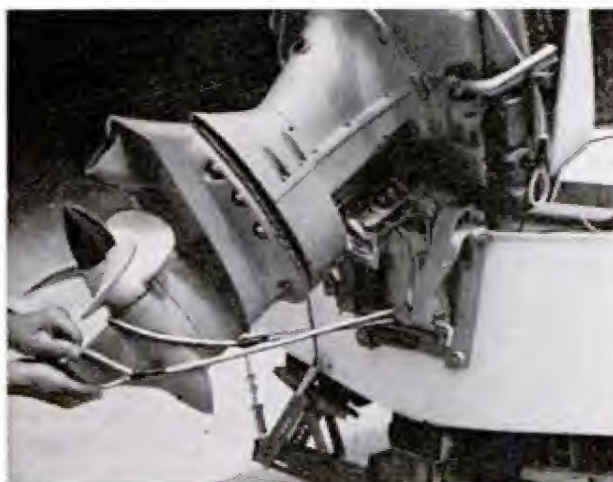
PLASTIC TAPE wrapped tightly around rope parts of splice covers metal hog rings and cut end of cord, making stronger, neater splice that won't slip or become undone when subjected to heavy strain



ENDLESS TYPE of tie-down is used here to secure anchor, paddle and other gear to motor-well bulkhead. Tension on cord keeps these items snugly in place even when water is rough, yet it can be removed very quickly simply by unhooking the snap



CONVERTIBLE BOAT TOP is held firmly in extended position by shock cord ties attached permanently to each side of the U-frame member. Loops on ends of tie-down slip on small cleats fastened to structural members port and starb'd on inside of hull

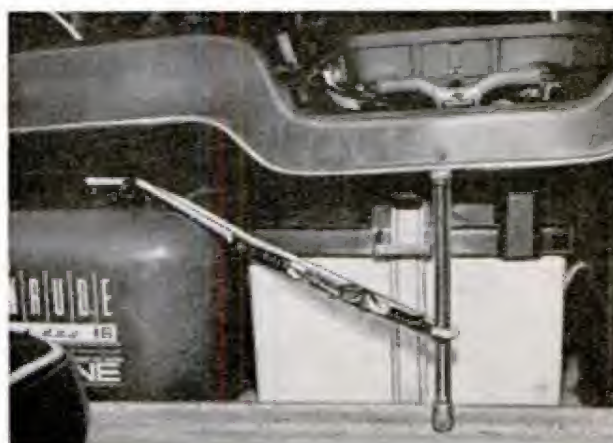


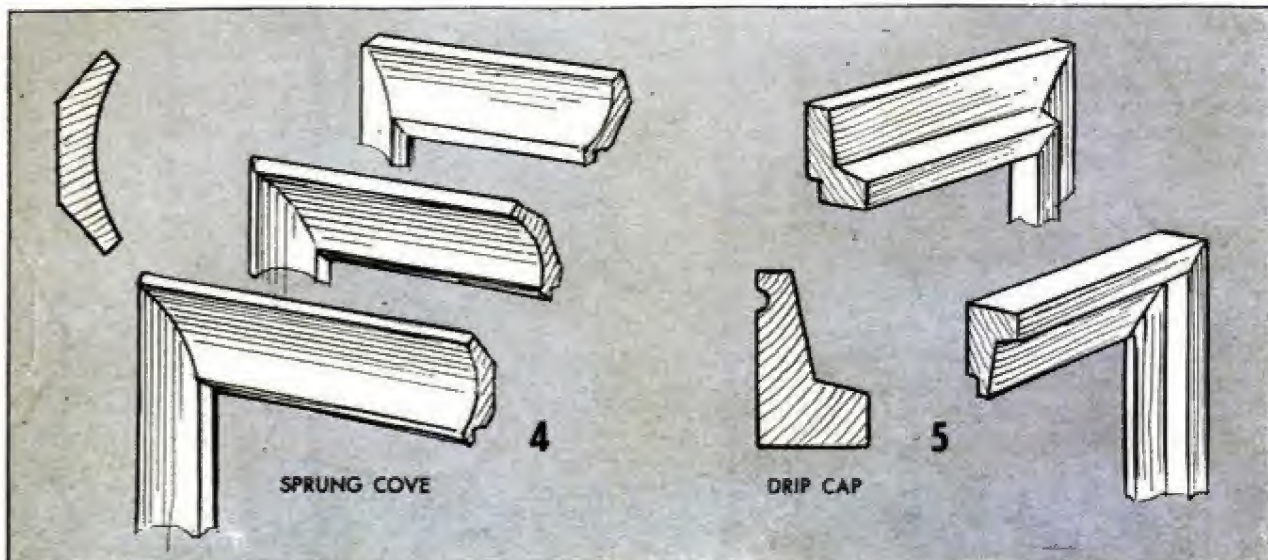
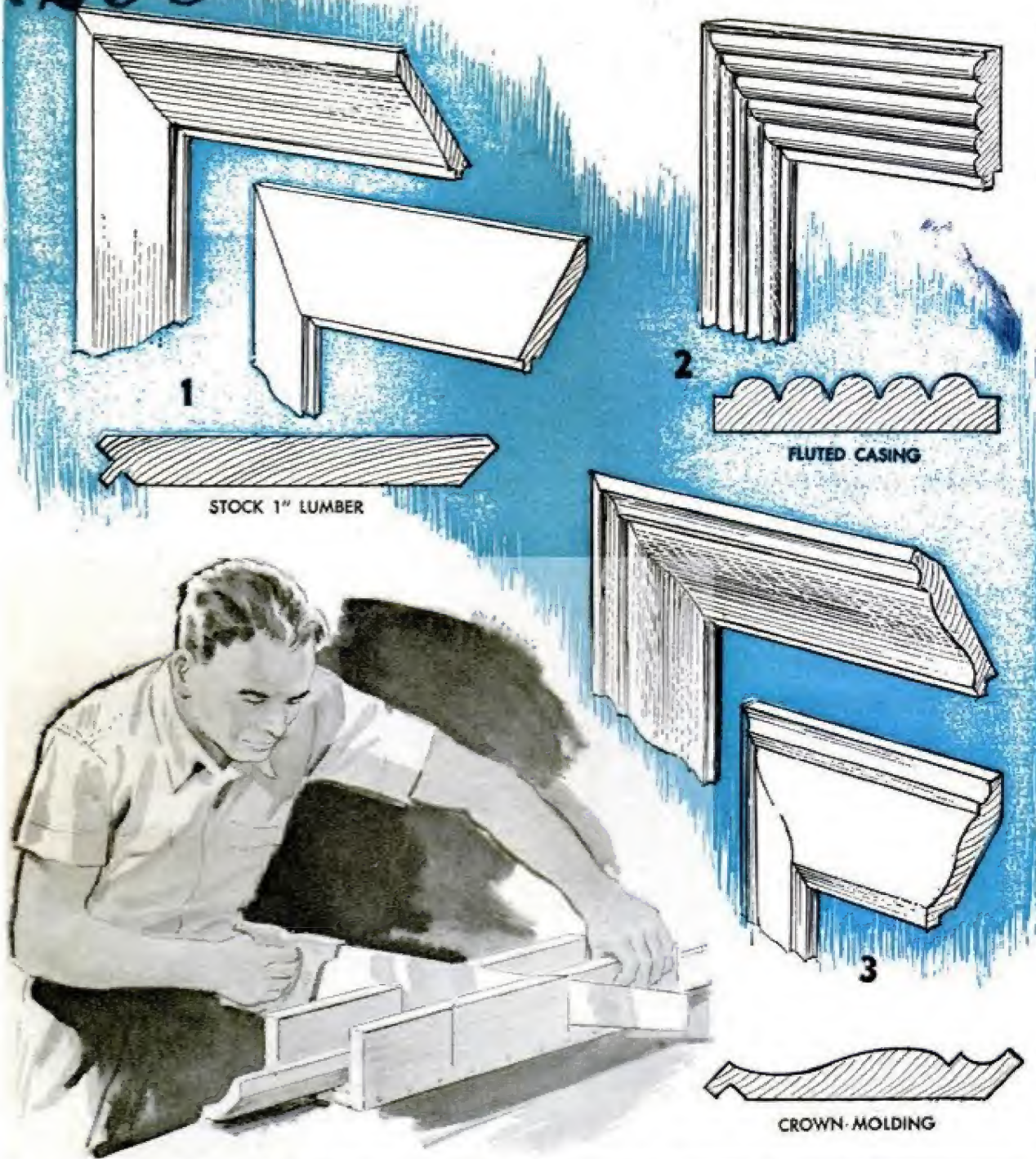
HEAVY MOTOR trailed in full-tilt position as shown above, is prevented from rocking on tilt pin by snubbing the lower unit tight with tie having loop spliced on each end. Loops are made large enough to be slipped over skeg and gearcase housing. Center of tie is looped over tilt pin. Another such tie looped over the motor steering bracket and made fast to stern cleat on each side of boat, holds motor straight, keeping its weight centered on transom



TENSION TRANSFERRED to boat cover by shock cord tie-down, prevents it from flapping, minimizing chafe on the boat's finish and wear on the cover. This is especially important if the boat is trailed with a cover on. Fiber-rope tie-downs lengthen under strain, leaving the cover loose to thrash about in the wind

PORTABLE FUEL TANK located where conventional tank holders can't be used, is held in place by shock cord having ring on one end and snap on other end. Two such hold-downs are used, each looped through the tank handle and secured to a part of the boat easily accessible in the manner shown in the photo





LUMBERYARD PICTURE FRAMES

There are picture frames galore waiting for you at your lumberyard at a fraction of the price you would pay at a store. Stock builders' moldings offer a wide selection of shapes at pennies per foot

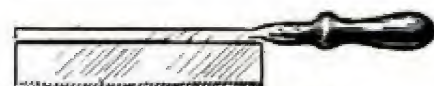
By E. R. Haan

WHO WOULD THINK of going to a lumberyard for picture-frame molding! But there you'll find an array of standard molding shapes that will frame your pictures for a song. Priced by the foot, the molding is nicely shaped from choice grades of pine and other woods and needs only to be mitered to length, Figs. 1 through 5. Some moldings are already rabbeted, on others the rabbet is formed with a second molding, Fig. 8. All have one thing in common, they're comparatively inexpensive.

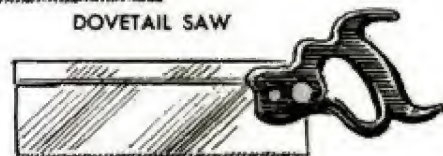
Figuring Molding Lengths

To determine molding length required for a desired glass size, add the height and width of the glass and multiply by two. To this add the width of the frame multiplied by eight. For example, in case of an 11x14-in. glass-size, twice the height and width is 50 in. For a frame 2 in. wide, add 16 in. to 50, totaling 66 in. or 5½ ft. to allow for waste.

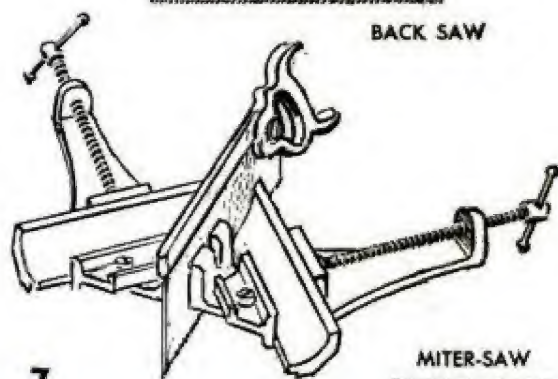
Unfinished molding to be given a transparent coating should receive a coat of sealer to avoid stains from glue. Many



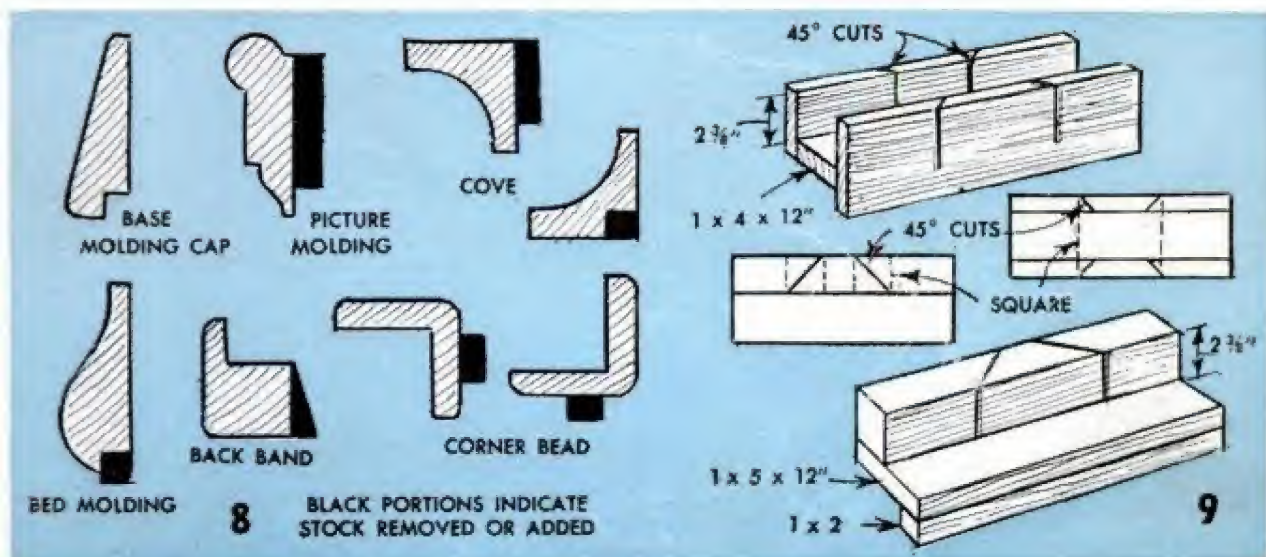
DOVETAIL SAW

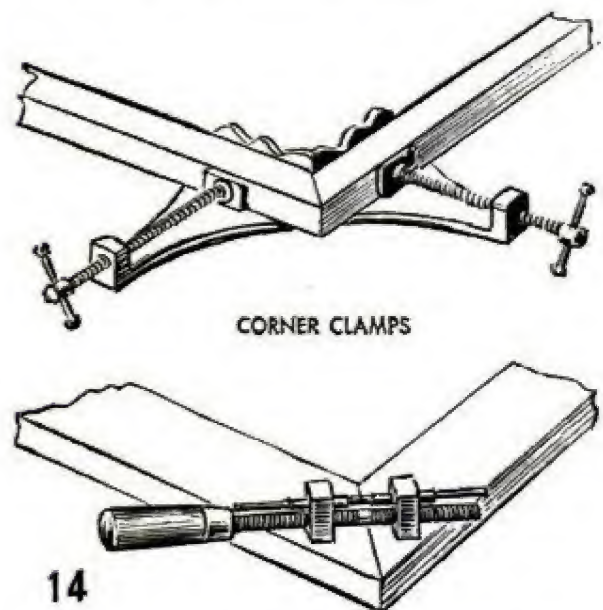
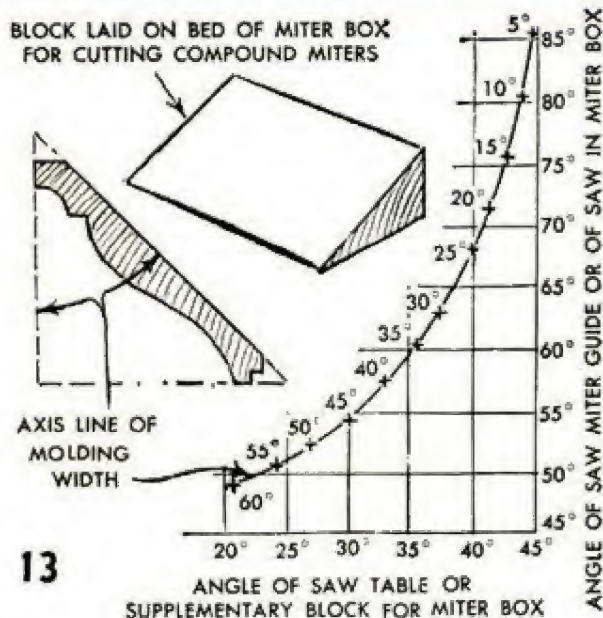
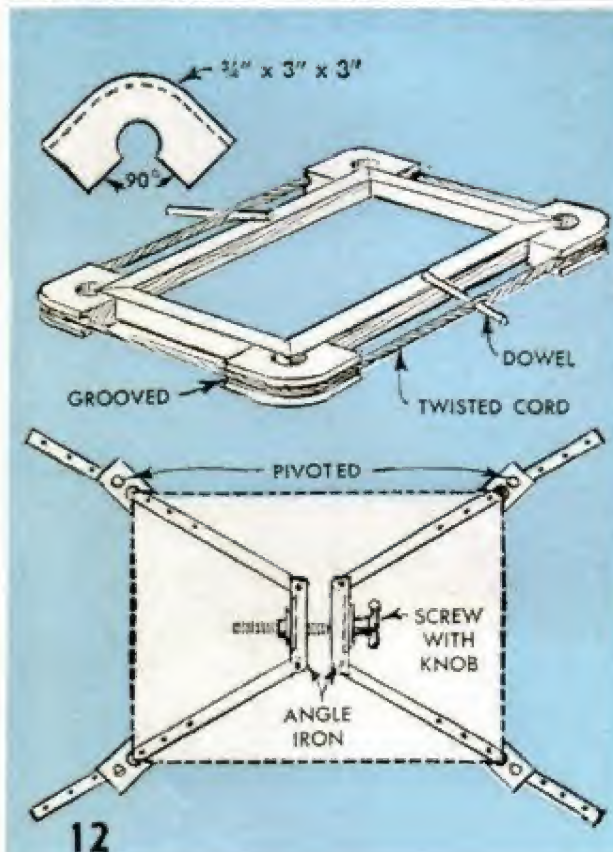


BACK SAW



MITER-SAW
GUIDE & CLAMP





pleasing effects are obtained by making the grain of the wood contrast with a colored, semitransparent toner. Molding also can be covered with self-adhering sheet plastic having an imitation-wood finish.

Guides for Miter Sawing

If you haven't a circular saw to cut miters accurately, use a fine-toothed hand-saw such as a dovetail or back saw, Fig. 7, plus a suitable miter-sawing guide. Fig. 7 also shows an inexpensive combination miter-sawing guide and clamp.

A homemade miter guide and miter box are shown in Fig. 9. The dimensions given are intended for a back saw having a cutting depth of $2\frac{1}{2}$ in. To mark a block or box for cutting the 45-deg. saw kerfs, use a sharp pencil to make perfect diagonal gauge lines as in Fig. 9. Also draw vertical lines on the sides for checking the cut while sawing. The 45-deg. kerfs in the guide should be made by the saw to be used in them or one of identical thickness and set. One edge of the kerf should be right on the fine diagonal lines.



15

Using Miter-Saw Guides

Place the molding in the miter-saw guide or box so its back rests on the bottom and one edge comes snugly against one side. The molding must be held immovable—preferably clamped—in this position while sawing. Start the cut by drawing the saw backwards to prevent chipping the molding. To avoid a ragged back edge, place the molding on a strip of hardboard. If this is not done, the ragged edge must be removed carefully with fine sandpaper. Smoothly cut miters do not require sanding or planing, which sometimes changes the bevel or causes other damage.

Laying Out Frame for Cutting

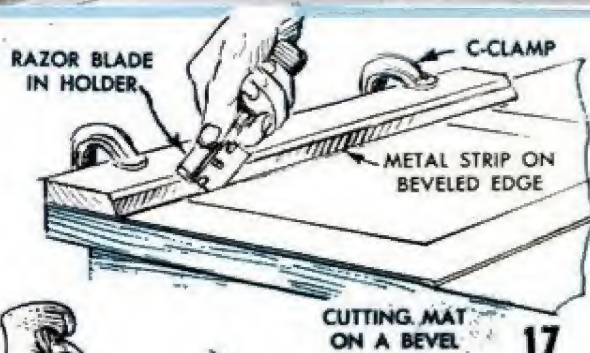
For aligning the molding visibly, with the saw at the point where it is to cut, mark the outside edge of the molding. After cutting off one end at 45 deg., locate the mark for the next miter cut as follows: Measure the width of the molding from the outer edge to the bottom of the rabbet but not to the inner edge of the molding. Add twice this distance to the length of one edge of the glass, plus $\frac{1}{16}$ in. for clearance. This gives the exact length of the molding along the outer edge from the corner already cut.

Compound Miters

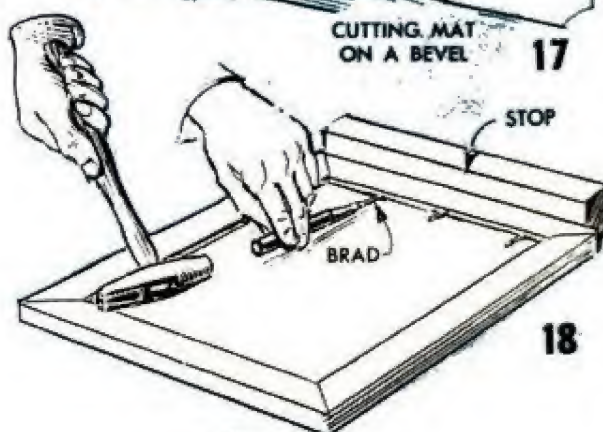
Hopper-type frames require compound miter cuts. Lacking a circular saw with its accurate miter gauge and tilting arbor you can use a sloping block in a miter box, Fig. 13. When cutting compound miters, use a miter box that is adjustable. Extreme accuracy is highly important for sawing compound miters. For frames having sides that slope 45 deg., the miter-gauge or miter-saw angle is $54\frac{3}{4}$ deg., while the table tilt or the angle of the supplementary block in a miter box is 30 deg. You can find this in graph, Fig. 13, which covers various slopes of picture frames.



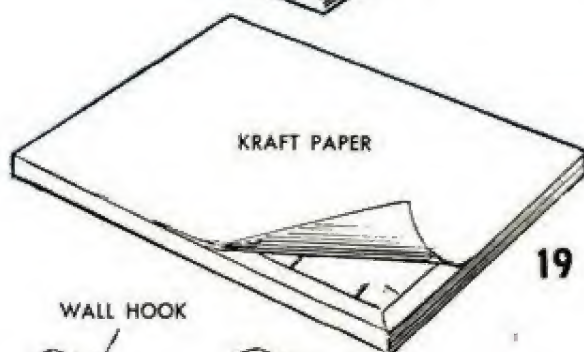
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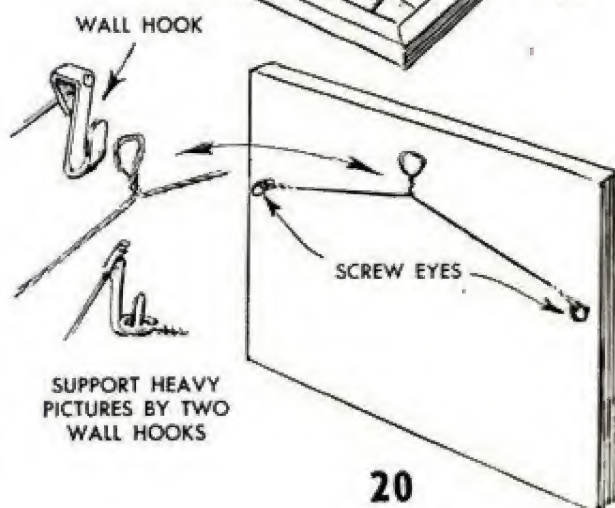
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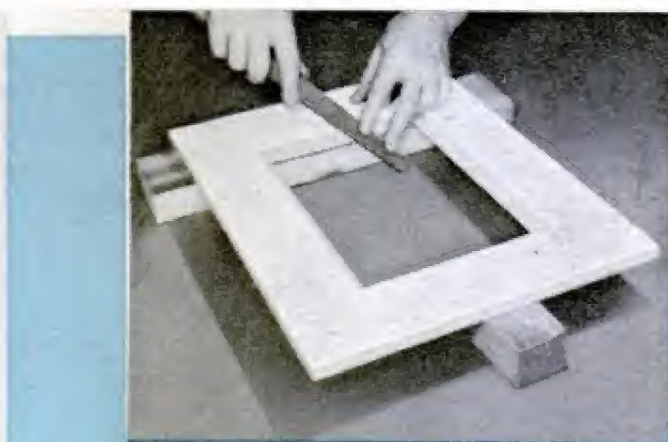


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Assembling Frames

Check the four lengths of molding for accuracy. Assembling the pieces with glue and brads or finishing nails of suitable size is next. Often, small nails can be driven into soft molding without splitting it, even though no pilot holes are provided. But to forestall the risk of splitting, pilot holes are available, especially in hardwood. Generally a pilot hole needs to extend only from the outer edge of the molding to the miter cut—not into the joining molding.

After both pieces are glue-coated, place them together in a corner clamp, Figs. 10 and 14. Leave the molding in the clamps until the glue has dried.

Miter clamps that draw up the four corners of a mitered frame are shown in Fig. 12. However, when using these you glue the corners first but do the nailing after the glue has dried and the frame is removed from the clamp. For nailing, hold each side of the frame in a vise, using smooth, protective strips of hardboard on the finish side.

You can also glue and nail all corners of a frame freehand. To join corners freehand, chuck one member in a vise, using a protective pad against the molded surface and a backing piece such as plywood, Fig. 11. When joining molding, wipe off all excess glue with a damp cloth.

Mounting the Picture

Most pictures look best when offset by mats. Almost any thick paper of dull finish, preferably textured, will do. Thin paper is apt to buckle from moisture absorption. Best material to use is regular mat board. Interesting wood-grain and marble-

ized effects on mats are possible by covering cardboard with self-adhering sheet plastic. Another attractive effect is obtained by using $\frac{1}{8}$ -in. perforated hardboard against a colored background.

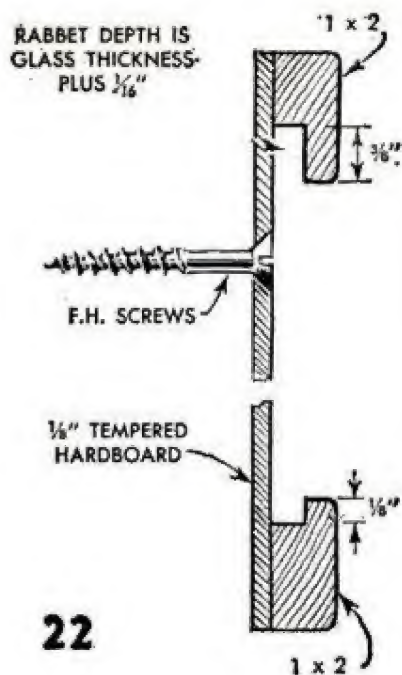
The picture should overlap the mat no less than $\frac{3}{8}$ in. Cut openings in matboard with a sharp razor blade held in a substantial holder; run the blade along a metal straightedge. For an angle cut, use a beveled straightedge as in Fig. 17. Mats often can be improved by black or colored ink lines drawn close to the edges as in Fig. 15. The picture is fastened to the mat with glue or removable tape.

The backing may be cardboard or corrugated board to bring the surface a trifle below the edge of the frame to permit the backing to be fastened with brads. On small frames you can push brads in gently with pliers, Fig. 16. For large frames, use a light hammer and punch, Fig. 18. After the brads are in place, seal the back of the picture with heavy paper to keep out dust, Fig. 19.

Screweyes used for hanging pictures generally are located from a third to a fourth of the picture height from the top edge as in Fig. 20. A loop formed at the center of picture wire as in Fig. 20 keeps a picture hanging straight, Fig. 6. Heavy pictures should be supported by two hooks.

Novelty Frames of Softboard

Attractive picture frames without glass, Fig. 21, can be made of soft wallboard. The outside edges are cut on a circular saw and then smoothed with sandpaper. The beveled cut is made as follows: Mark the position of the innermost edge on both



sides and cut halfway through the board from each side. Place the frame on blocks as in Fig. 21. With the finish side up, a medium-coarse file is used to dress off the beveled edges. Such frames are hung by gummed eyelet tabs as shown in Fig. 24.

Gang Frames

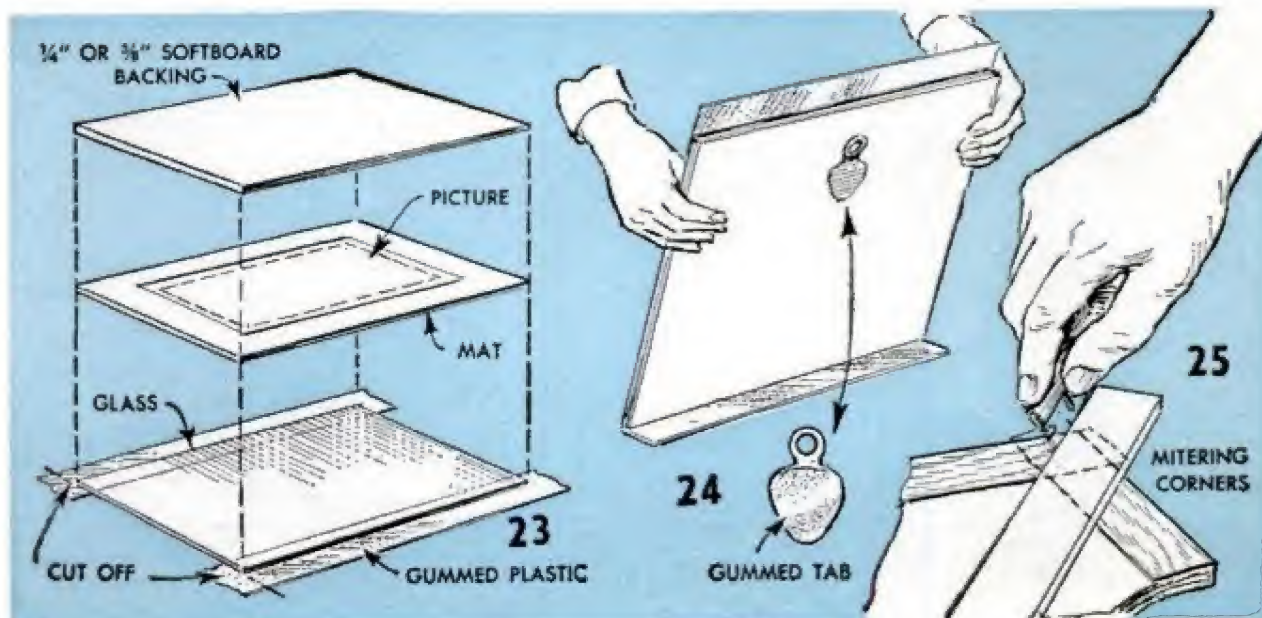
The frame in Fig. 22 holds several pictures of equal size and permits them to be exchanged quickly. Each picture is set behind a glass pane of the same size. Both are inserted into the upper rabbet and dropped into the shallow rabbet in the lower molding.

Imitation Frames of Sheet Plastic

Imitation wood frames can be made from strips of gummed sheet plastic. A

backing of softboard gives the desired thickness, Fig. 23. Place the glass carefully on the two strips. Hold the glass, mat, and backing together firmly while turning the assembly over. Next, apply the two other strips to the glass. Before fastening these to the back, make a miter cut at each corner with a sharp razor blade to eliminate overlap, Fig. 25. To minimize opening mitered joints, avoid stretching the tape lengthwise when applying it. Pictures so assembled are provided with gummed eyelet tabs for hanging.

Besides the imitation wood tapes, many other colorful plastic tapes are available. When a decorating change is wanted, simply add a new tape to the frame. ★ ★ ★



BETTER

By George Laycock



WHEN PHOTOGRAPHING action, be sure to show the subject moving into the picture and not out of frame as seen in print above

FOREGROUND FIGURES add interest and depth to your travel photographs. Show person looking into scene



AMATEUR photographers shoot more than two billion snapshots a year. That's a lot of pictures, but the sad side of the story is that a large number of them are ruined in the making. Film manufacturers, in fact, estimate that of the 2.2 billion snapshots made last year about a third of them were spoiled by making improper exposures.

But usually the faults can be easily corrected by the person who holds the camera. There are a few basic rules for making good photographs, and once you understand and observe these rules your pictures are sure to be more satisfying and interesting.

Exposure

The most common error in taking pictures is improper exposure. Yet this problem is quickly solved by following the instructions given on the data sheet which comes with each package of

film. Determine the basic exposure that works best with your film in direct sunlight. Then vary the exposure only as the lighting conditions change. The film data sheet lists these varying conditions. When you've once found the right combination, stick with it except when experimenting.

An exposure meter makes an excellent tool for calculating exposures, but don't expect the meter to think for you. It's necessary to learn the correct handling of a meter before it will serve you properly.

Fuzziness

Fuzzy photographs are the result of camera or subject movement, or of an out-of-focus lens. Camera movement alone ruins hundreds of thousands of photographs every year. To avoid this, practice until all the camera operations become habit. Brace the elbows and press the shutter gradually. Be careful not to jerk the release. By establishing a routine method of operation, good camera work soon becomes a habit.

To stop subject movement, use a shutter speed fast enough to stop all motion. Action moving approximately at right angles to the camera requires a much faster shutter speed than action moving towards or away

from the camera. In many activities there are short periods of arrested action, such as at the end of a ball player's swing.

Out-of-focus pictures result if the lens is used with the wrong setting or if focusing is neglected. When the lens opening is set at $f/4.5$ to $f/2$, the depth of field may be so shallow that sections of the picture will be fuzzy. You can correct this by stopping down the lens diaphragm.

Composing the Picture

When looking into the viewfinder, keep in mind that the finder itself is not capable of selecting one subject as more interesting than another. It sees them all, including the garbage cans and the children's toys. This is where you come in. You should select your subject so that it shows only one point of interest. Then emphasize that point and subordinate or eliminate all the rest. If a view is cluttered up with too many competing points of interest, the whole composition falls apart.

Most photographers back away too far from their subjects. You should move in close enough to eliminate the confusing backgrounds and objects that only compete for attention with the main subject.

GET SOMETHING into your travel pictures besides a general landscape. This scene lacks a point of interest



If people are included in the picture, have them doing something, or at least have them looking at something other than the camera. If you photograph a man holding a fish or a couple of rabbits, show him looking at the game, not the camera. This draws attention to the main interest.

By photographing your subjects against simple backgrounds, you eliminate confusion and emphasize the subject. Pictures, for instance, of people in front of automobiles are usually uninteresting. If you want a car in the picture, why not photograph your subject driving the car or loading fishing gear into it? This helps tell a story and adds interest to the picture. And it moves the car out of the background, making it part of the subject.

Watch for such background distractions as electrical wires, telephone poles and unsightly signs. One of the simplest and best backgrounds is the sky.

Once you learn these few basic rules about making good pictures, try experimenting with camera angles. Instead of making all your photographs from shoulder height, try shooting from a few inches above the ground. Or, bring out a ladder for some high-angle shots. You will find, by using various angles, you can emphasize or minimize different parts of the subject. The news photographer's "cheesecake" shots



MOVE CLOSE enough to eliminate distracting details are invariably made from a low angle. So vary your camera angles to add drama and interest to your photographs.

The mood of a picture can be created with lighting. Outdoors you can't swing the sun to just the desired location, but you can select the best time of day.

UNDEREXPOSED NEGATIVES lack detail in the shadow areas. And when such negatives are printed, the photographs usually appear muddy, with the dark areas blending together. Prints lack good snappy tones





COMMON MISTAKE is getting too far from subject

When you photograph people in bright sunlight, with the sun directly in their eyes, it will make them squint. By turning the subject around you can add snap to the picture with backlighting and put an end to the squinting. With backlighting subjects increase the exposure or fill in the shad-



WATCH BACKGROUNDS to avoid a grotesque effect

ows with flash or reflector to reduce lighting contrast. Also, make sure the lens is protected from direct sunlight.

Spend a little time studying the shifting play of light and shadow. You'll find an endless variation of tones and moods created by the changing patterns. ★ ★ ★

OVEREXPOSED NEGATIVES usually print up without good detail in the highlights. The prints lack the sparkling tones and the crisp lines which are seen in photographs made from normally exposed negatives





From Boston to California, Indianapolis champs of tomorrow are cutting their racing teeth on dirt tracks, behind the wheels of speedy, thrill-a-minute midgets. Here's the lowdown on the latest development in the power-cart picture—power for one or both wheels



TWO-ENGINE

INSTALLATION of the engines is quite simple, requiring only hand tools and a bit of patience. The clutch, for example, is adjusted with no more than a socket-head type wrench as is illustrated in the photograph above left

FELLOW AT LEFT has mounted one engine and is setting the other in place. To drive both wheels in the same direction, engines rotate in opposite directions and are mounted accordingly

FOR MAXIMUM delivery of power, chains must properly engage sprocket teeth, below, and must be given the right amount of play. For minor adjustments, engines are moved in mounting holes before final tightening of bolts



YOUNG FOLKS the country over are becoming aware of the sound of tiny engines, the screech of brakes—all the excitement of driving a power cart. What's more, these are not luxury items, but within the reach of any young racer eager to get into the roaring din of the track. For those hardened young track veterans, there's more news. A set of new engines, built especially for power carts, makes it possible to assemble a two-engine racer with full 5 hp., qualifying it for class B competition.

Installation of the engines is quite simple. The clutch is first locked on the drive shaft by means of a socket setscrew mounted on the clutch assembly, as shown in the photograph at the top of the page. Then matching engines are set on the mounting brackets with the clockwise rotating en-





POWER CARTS KICK UP DUST

gine on the right and the counter-clockwise on the left, illustrated below.

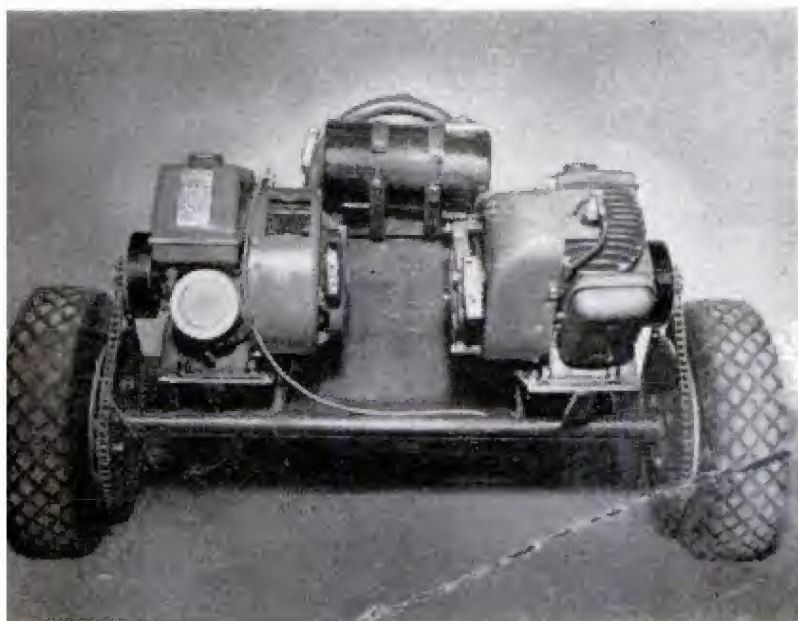
The reversed rotation of one unit is necessary so that both wheels may be driven in the same direction. Each engine is loosely bolted to the brackets, after which the inside of the wheel sprocket is aligned with the inside of the sprocket on the clutch. Minor adjustments may be made by shifting the engine on its mounting plate. Both the mounting plate and engine base can be marked so that the alignment can be kept when the engine is moved forward for chain adjustment. Make sure that the

chains engage properly, as shown on the opposite page, to avoid any chance of drop or mesh in the chain to the sprockets. The engine is moved forward to a point where there is from $\frac{1}{2}$ to $\frac{3}{4}$ in. of play in the chain and the mounting bolts are tightened.

The two most popular throttle control hook-ups are one which uses a speed-control lever, and one which connects the accelerator pedal linkage directly to the carburetor, without the use of a governor. The linkage connects a speed-control lever which governs the speed of the engine up to 3800 r.p.m. ★★★

TOUGH LOOKING little customer below is the business-end of a power cart fully assembled and equipped with matching single-cylinder, air-cooled engines

LINKAGE CONNECTS accelerator pedal with a speed control lever, or governor, which serves to hold the speed of the engine to a maximum of 3800 r.p.m.



Trouble Shooting THE TOUGH ONES

By Ben L. Davis

ONE DAY during a breather Bill and I sat in the shop kicking around some of the really puzzling jobs we'd had, and he came up with real poser. Seems a fellow came in with a '51 Chevy he'd bought off the lot. Only 8000 miles on it and the buggy looked to be in pretty fair shape. New plugs, wiring, carburetor—an all around clean and well-cared-for job. But, the first time he took the car out on the road, up pops trouble. Seems he hit a stretch of rough pavement some 10 miles out and the engine up and died. But not a minute later, it kicks right over again. Bill gave it the once over next day. Timing, compression, ignition, fuel feed and carburetion—all were good. Now, Bill's a shrewd one and figured the best way to find the trouble was to put the car through the same paces that brought on this unusual performance.

Over the highway he goes and over another rough stretch—and sure enough the engine expires. But just before it died Bill

noted a brief period of misfire. Quick as a flash he's out and under the hood. But, the spark's good, fuel perfect and again the engine kicks right over. Scratching his head, Bill heads back to the shop. A thorough check shows the water level in the radiator to be pretty low, and this he figured might be a clue. Removing the plugs and cranking the engine showed no moisture coming from the cylinders—so, no water jacket to cylinder leak. Under a radiator pressure test there it is—a drip from the heater hose next to the distributor. Shaking the hose opened the fine crack and hot water squirted over the distributor cap and up into Bill's face. Bumps shook the hose just enough to cause water to squirt out, causing a short in the high-tension current at the plug wires. Of course, engine compartment heat dried this up before anybody could spot it and the engine would always start as though nothing at all had happened.

Unusual Locations Where Trouble May Occur

Chevy Dashboard Noises

Owners of the '59 Chevy may hear noises and rattles coming from under the dashboard. Two possibilities are the speedometer-cable housing rubbing against a dash member and a low whistle from the air-vent housing. Silence the speedometer noise by enclosing the housing in a length of slit rubber tubing. Put the quietus on the whistling by sealing the air-vent housing.



Loose Volkswagen Shifting

Don't let the loose and troublesome shifting on a high-mileage, well used Volkswagen give you undue cold sweat. Chances are you don't need an expensive transmission overhaul but only replacement of the shift plate. The plate is under the base of the shift lever and is secured by the same two bolts, making replacement a relatively quick and inexpensive repair.





Galaxie Weather Seal Can Hinder Door Opening

Effective door sealing can cause other problems. For example, on the '60 Ford Galaxie 4-door hardtop, opening a rear door with the glass up takes a bit of muscle since the window frame presses against a firm weather seal for the first few inches. Try applying a bit of chassis grease or a special lubricant along the seals. This should relieve the tendency to stick.



SEPTEMBER 1960

Aging V-8 Chevy May Develop Heat-Valve Rattle

Like a man approaching middle age, cars can develop creaky joints, rattles and wheezes. A V-8 Chevy for instance, may develop an annoying rattle under the hood. Should this noise pop up when the engine is accelerated, take a look at the manifold heat valve. Best cure is to replace the valve assembly—a simple task. It is bolted between the manifold and the exhaust pipe.



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"Third Hand" on Paper Cutter Catches Cutoffs and Trimmings

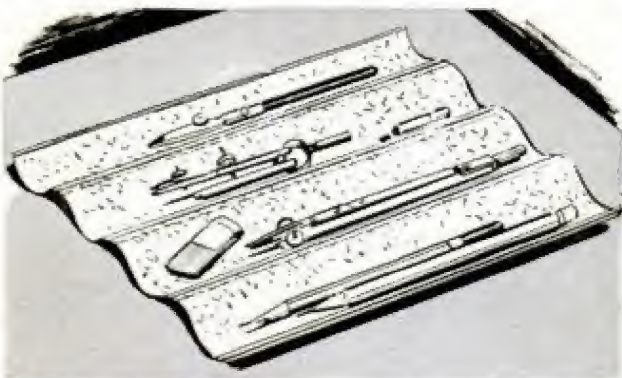
One of the disadvantages of using a paper cutter at the end of a table is that there is nothing to catch the cutoffs. When left-overs amount to more than mere trimmings, it becomes a bit of a juggling act to hold the work and keep it from dropping to the floor. A simple solution is to place a sheet of hardboard or cardboard under the cutter and let it extend over the edge of the table to form an outboard shelf. The weight of the cutter will hold it level and when the shelf is not needed, it can be pushed back under the cutter.

Printers in a hurry can take proofs without having to ink up the press. Lock the form and chase in the press and back the proof paper on the platen with several sheets of newspaper. Place a sheet of carbon paper over the proof sheet and close the press for a clean, readable proof.



Slit Section of Plastic Hose Makes Self-Locking Sander

When smoothing concave surfaces, a section of dowel is all right as a sanding block, but here is something better. Slit a 3-in. section of plastic garden hose and insert one edge of the sandpaper into the slit. Then wrap the paper around the hose and insert the other edge. The paper will be securely clamped as soon as hand pressure is applied.—Bil Toman



Corrugated Tray Holds Instruments On Tilted Drawing Board

How can you prevent drafting instruments from sliding off a tilted drawing board? Use a piece of corrugated aluminum roofing as a tray. The corrugations provide a series of handy individual troughs that not only keep your instruments separated but easy to pick up. Tabs of masking tape can be used to keep the tray stuck securely to the tilted board.



Can Slides Down Fishing Line To Free Snagged Hooks

When he snagged his hook on submerged tree roots and lost his fishing lure for the third time, one fisherman decided to do something about it and came up with the following idea: He removed the ends from a coffee can and slid the can down the line to the snagged hook. A little manipulation and in most cases the hook was freed.

TOOL IQ



1. EARLY WOODTURNERS kept this tool handy to check on progress of work. It usually was made by the village blacksmith, or ironsmith, as he was sometimes called. Note variation in radii of the fixed legs



2. SURE YOU KNOW what it is? Study it closely before you come up with an answer. Great grandfathers used this tool to cut round-end mortises in fence posts to take ends of rails. The cutting edge is curved



3. OF COURSE, YOU'VE ALREADY GUESSED what this is—or have you? It was made from a tree limb with a natural bend, or crook. No doubt it took some searching to locate one suited to the craftsman's purpose



4. WHEN ONE VIEWS the skilfully wrought work turned out by early cabinet and coachmakers it's difficult to believe that this was one of the tools they used to cut fine woods to the sizes and shapes required



5. TAKE YOUR TIME on this one. You're right. It was used by coopers (the fellows who made barrels) to cut the chamfer on the staves at top and bottom of barrel. But they had a name for it. What was it called?



Turn to
page 218
for answers.

6. THIS VENERABLE TOOL is thought to have been made by colonists about the year 1600, possibly earlier. We don't know precisely when, but we know it was one of the first edged tools used by early craftsmen



On the MARKET for Do-It-Yourselfers

SELF-ADHERING NYLON TAPE, above, makes any drawer slide easily without use of any other friction-reducing device or material such as wax or other lubricants. To apply, remove paper backing and press into contact on the drawer slide, or underside of the drawer sides. Adheres to wood, metal, plastic.

Hardware Designers, Inc., P. O. Box 4, S. Hackensack, N. J.

COMPLETE FINISHING KIT, below, is made up especially for those who need only small quantities of finishing materials for a given job. Kit consists of 5 containers of finishing material, brush and 3 sheets of 5-0 and 7-0 sandpaper. Available in natural, mahogany, fruitwood, maple, cherry, ebony, blond, golden oak.

Homewood Industries, Inc., 26 Court St., Brooklyn, N. Y.



SHELF KIT, above, center, consists of four 10-in. hardwood spacers, four 14-in. spacers, four end caps, and four 4-in. legs with brass ferrules. This kit provides spacers and legs for three shelves. All individual parts are available separately, making it possible to build up any convenient number of shelves.

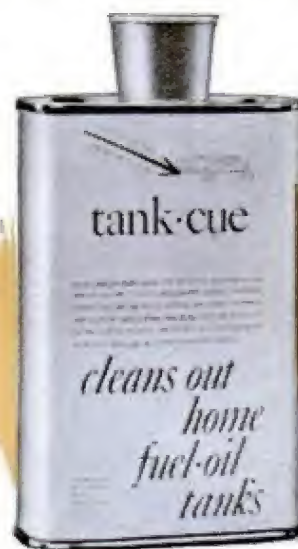
Stanley-Judd, Div. of Stanley Wks., Wallingford, Conn.

GLITTER in tubes, above right, is a novel decorative material. Each tube contains a mixture of adhesive and glitter particles. The tubes have special tips which serve as applicators, or pens, which make glittering a simple matter of applying the material over pattern lines or freehand as you choose.

O. E. Linck Co., Inc., Junction Routes 3 and 46, Clifton, N. J.

ADDITIVE cleans fuel-oil tanks of oil-fired home heating systems, prevents clogged burner nozzles and strainers and inhibits soot formation. Ordinary usage calls for adding about 4 oz. of the solvent to each 250 gallons of oil but this may be varied somewhat to suit special conditions. Follow instructions in all details.

Document House, Chemical Div., P. O. Box 242, Greenwich, Conn.





PREFINISHED PLYWOOD PANELING and matching flush doors are factory-coated with a grained plastic film which resists scuffing, fading and satining. Comes in five grained finishes, pecan, sandalwood, temple, walnut and cherry. Also redwood, hemlock and golden larch. Available in 1/4-in. thickness, 4 x 8 and 4 x 10-ft. panels
Simpson Logging Co., 1032 White Bldg., Seattle 1, Wash.

RUST PREVENTIVE in a spray can, below, left, takes care of household corrosion problems on tools, appliances, lawn mowers, fishing tackle—anything of metal which is subject to rusting. Keeps door locks working freely, prevents corrosion of car battery and battery mounting. Forms protective film on any surface
Rocket Chemical Co., Inc., 4674 Alvarado Canyon Rd., San Diego 20, Calif.

PAINT EDGER, below, center, enables do-it-yourself painters to produce clean, sharp ceiling lines, cut around window and door trim, baseboards, and moldings without overlaps when working with two colors. Consists of pad attached to aluminum frame fitted with two plastic wheels which serve as guides
Emerson House, P. O. Box 370, Downers Grove, Ill.

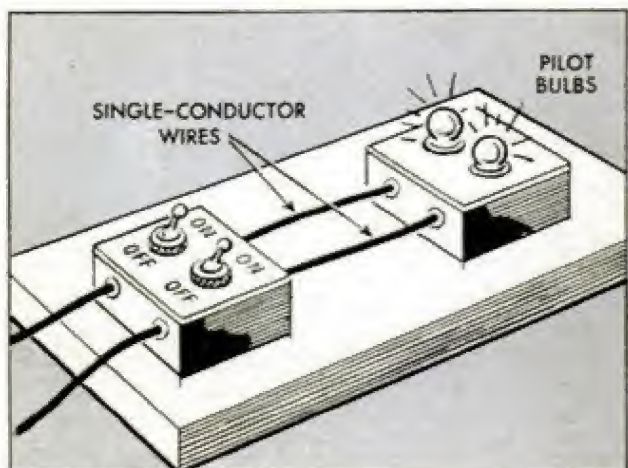
CHEMICAL PLASTICIZER prevents hardening of brushes used in any oil-base paints, varnishes or enamels. Just dip the brush full bristle length in the plasticizer and lay on a square of aluminum foil or any other non-absorbent material. Plasticizer is nonflammable and nontoxic and does not irritate the skin
Winfield Brooks Co., Inc., Woburn, Mass.





Venetian-Blind Slat on Board Protects Tracing-Paper Edge

Draftsmen and hobbyists—here's a tip for you. That complicated tracing job may require quite a bit of burning of the mid-night oil and in time, your constant leaning over the drawing board will rough up the bottom edge of the tracing paper, making it appear ragged and unsightly. To get around this, tack a venetian-blind slat along the bottom edge of the board as shown. It will protect the paper and has enough snap to enable it to hold the sheet firmly.—Warren L. Hockert



Electric-Circuit Puzzler Stumps the Experts

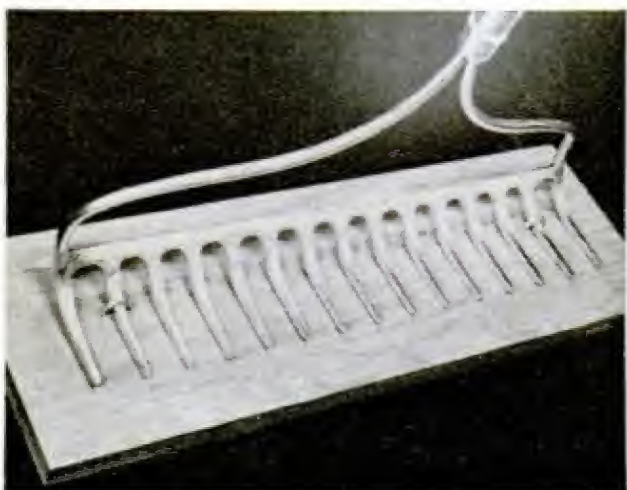
Here's a little device which can keep even a professional electrician guessing. At first glance there's nothing to it. Two pilot bulbs in one box are controlled independently by two switches in another box. Either bulb can be turned on or off by its own switch, or both may be turned off or on at the same time. But—and here's the hitch—only single conductor wires connect the switches to the bulbs. How is it done? For the answer turn to page 228.



Cutting Kerfs the Easy Way

There's an easy way to do almost everything including kerfing a strip of balsa wood preparatory to bending it. Clamp a hacksaw blade in the bench vise to the required depth of the kerfs. Hold the wood strip over the saw teeth and tap it with a hammer. The resulting series of kerfs will be uniform in depth.—G. E. Hendrickson

For a neat, organized workshop, suspend tools from hangers inserted in perforated hardboard. A white line traced around each tool indicates its proper place.

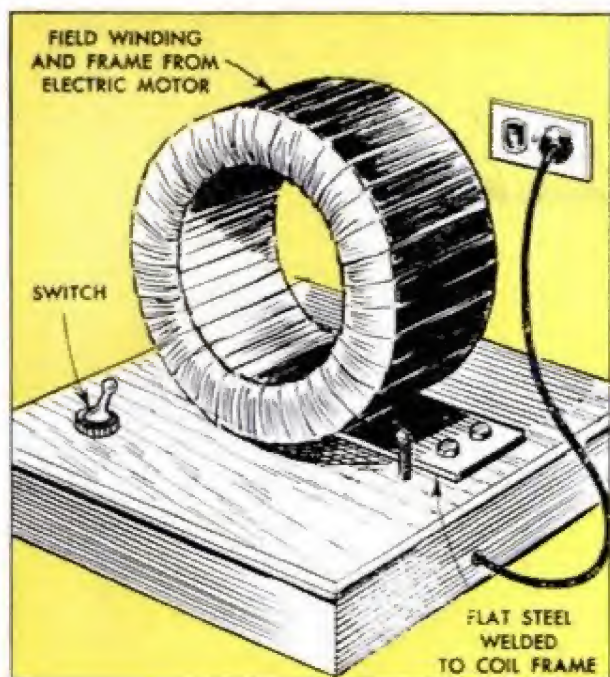


Rake Converts to Grade-Leveler

Say there, Mr. Handyman, if you need something with which to level off grading in preparation for seeding a lawn, your rake can be adapted to serve as a leveler and will do an excellent job. Just staple a piece of scrap lumber to the teeth of the rake, as shown, and go to work.

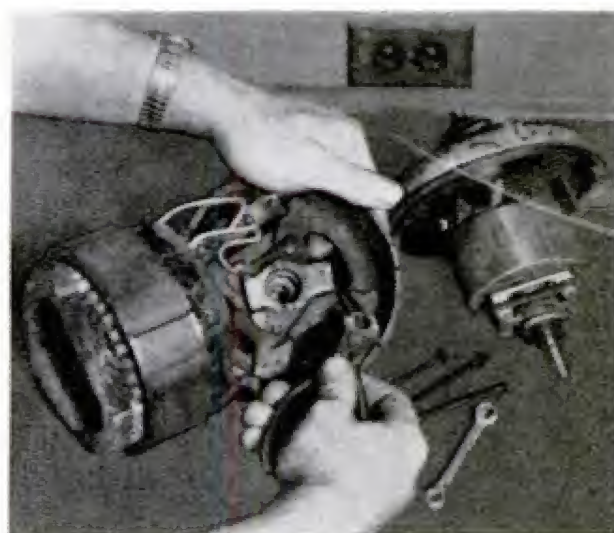
—Bil Toman

When stacking lumber for storage, lay the boards flat and place small wooden strips between them to allow the air to circulate. This will help prevent warping and checking, which otherwise would occur.



DEMAGNETIZE TOOLS IN SECONDS

The field and frame of a small, single-phase motor are used to make this combination demagnetizer and magnetizer. Remove the end shields, pull out the armature, cut the wires leading to the centrifugal switch and isolate the leads to the running coil. Cut all other leads short and tape the ends. Cover windings with friction tape. Provide a momentary contact switch of 10-amp. capacity. Wire the switch and coil in series to a heavy cord. To use as a demagnetizer, close and hold the switch and pass the object through the coil, in and then out, about one second in each direction. To magnetize, close switch and hold object stationary inside the coil.—Norman A. Kath



FIRST STEP in converting motor to demagnetizer is to remove end shields and cut leads to starting switch

Large Hex Nuts Make V-Blocks for Rough Work

When drilling transverse holes through round stock where the accuracy requirements permit, it is possible to make suitable V-blocks from large hex nuts. Holes are centered on the flats to take small bolts long enough to pass through two nuts. The holes should be slightly oversize so that when the bolts are tightened the meeting flats will be drawn tightly together. V-blocks made in this manner are suitable for use only in pairs.

To overcome any tendency of light-gauge metal to curl or buckle when welding, first tack-weld on a wide spacing. Then allow the parts to cool and tack-weld at points equidistant from the first tacks. Where several parts are to be welded the welds often can be made in rotation so that one part is cooling while other welds are made.



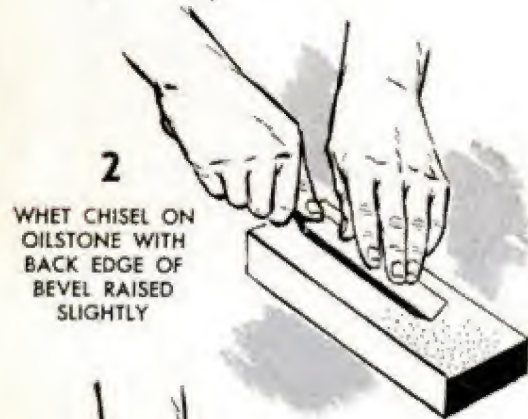
Shop Projects 1961

CHISEL TIPS

By C. W. Woodson



1
GRIND CHISEL
TO RESTORE
BEVEL. MOVE
BLADE IN DIREC-
TION OF ARROWS



2
WHET CHISEL ON
OILSTONE WITH
BACK EDGE OF
BEVEL RAISED
SLIGHTLY



3
REMOVE FEATHER
EDGE BY STROK-
ING ON OILSTONE
WITH FLAT SIDE
OF BLADE DOWN



- 1 BUTT CHISEL
- 2 PARTING CHISEL
- 3 SOCKET FIRMER CHISEL
- 4 SOCKET MORTISING CHISEL
- 5 OUTSIDE-BEVEL GOUGE
- 6 INSIDE-BEVEL GOUGE (BENT TANG)



4

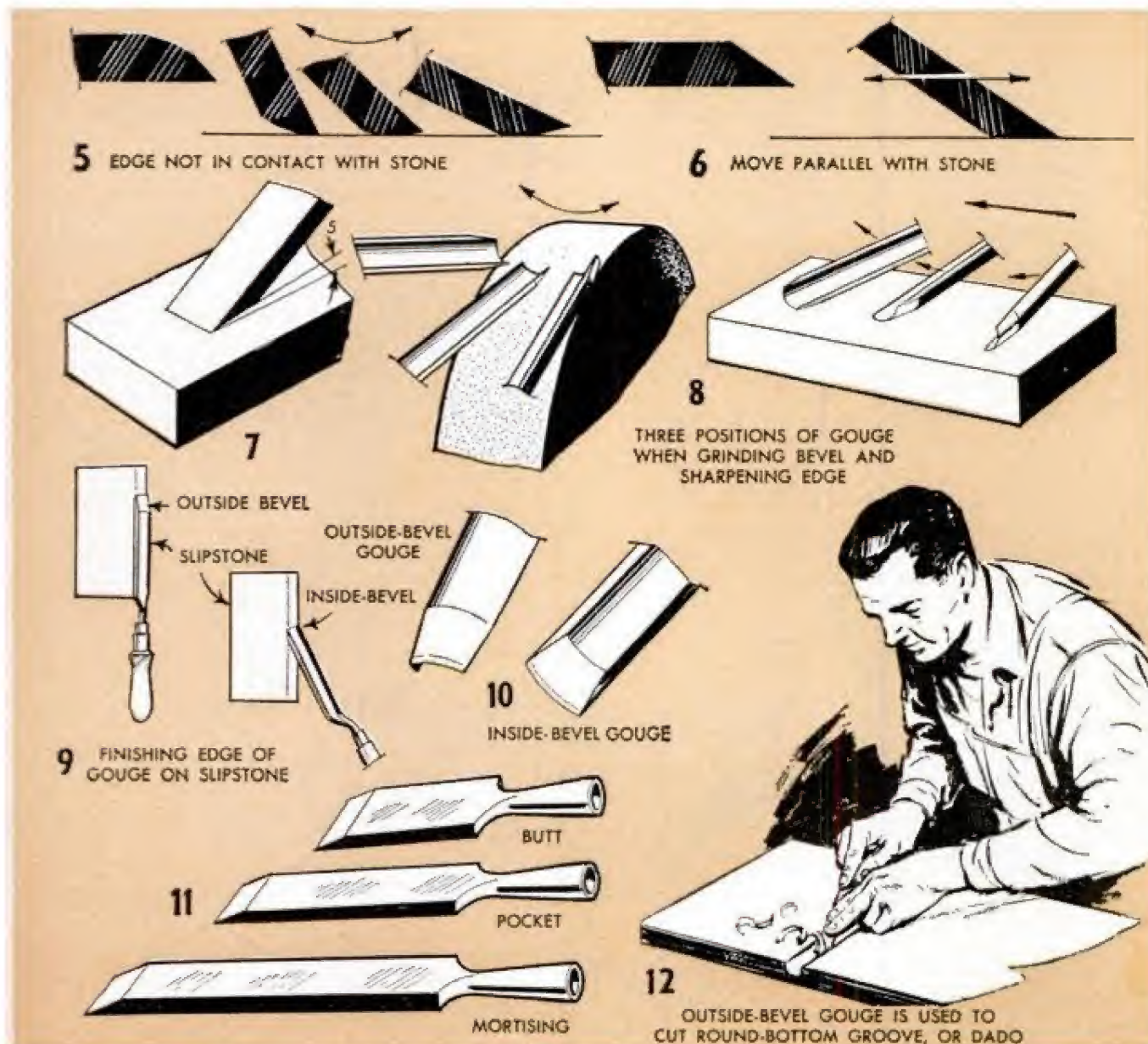
For Craftsmen Who Work With Hand Tools

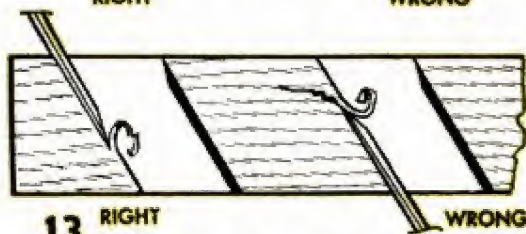
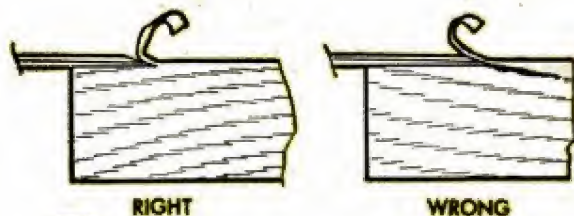
WHEN REPRODUCING old pieces and also in many types of custom work, skilled craftsmen still use wood chisels and gouges of various types to make cuts found in common cabinet joinery. In order to take full advantage of the versatility of these hand tools one must know the types and uses of chisels and gouges, how to handle them in hand work and how to sharpen each one to attain the keenest cutting edge.

In Fig. 4, illustrations 1 through 6 show types of wood chisels and gouges in common use. Chisel No. 2 also is referred to as a paring chisel; the others are usually referred to by the names given. The gouges, Nos. 5 and 6, Fig. 4, are of the types used for paring cuts. These tools are made in styles other than those shown. Sizes of all the chisel types vary in blade widths and lengths according to work requirements,

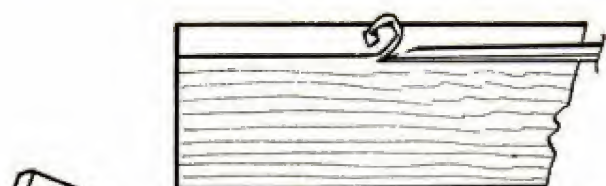
Fig. 11. Blade widths of chisels run from $\frac{1}{8}$ to 2 in. Note the difference in the edge bevels indicated in the lower details in Fig. 4. The paring chisel has a very long bevel at a 15-degree angle and is intended to be driven entirely by hand on light, accurate work. The firmer chisel edge is formed at a 20-degree bevel and serves as a general-purpose cutting edge to be driven by hand pressure alone and also by mallet blows. The mortising chisel is a sturdy, heavy-duty hand tool with a short beveled edge designed to withstand heavy mallet blows and moderate prying as must be done when making mortises.

Figs. 1, 2 and 3 outline the basic steps in sharpening a chisel. Note also in this connection the details in Figs. 5, 6 and 7. In sharpening on a high-speed grinder use a vitreous wheel and, if available, a sliding tool rest. In whetting the edge on the fine

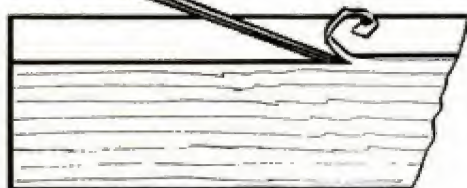




13 RIGHT
CUTS SHOULD ALWAYS BE MADE WITH GRAIN TO SEVER FIBERS AND LEAVE SURFACE SMOOTH. WORKING AGAINST GRAIN MAY CAUSE SPLINTERING



14 WHEN CUTTING DADO OR RABBET, CHISEL IS HELD WITH BEVEL UP

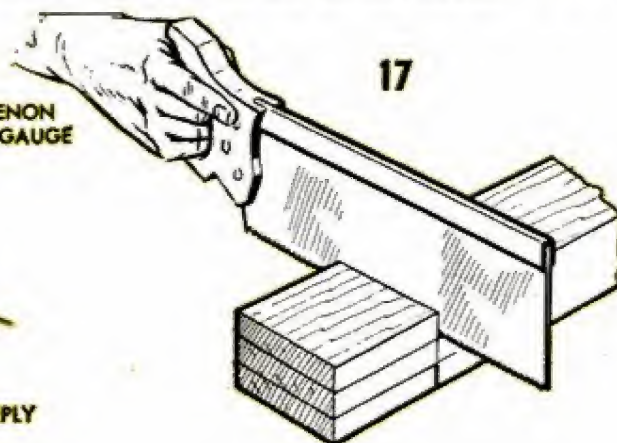


15 WHEN RABBET IS LONG, CHISEL IS HELD WITH BEVEL DOWN



16
LAYING OUT TENON WITH MARKING GAUGE

LAYOUT LINES SCORED DEEPLY

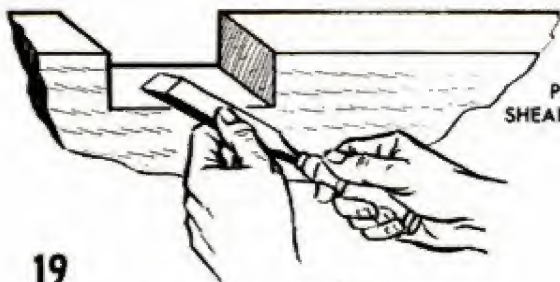


17

side of the oilstone, hold paring and firmer chisels with the back edge of the bevel raised about 5 degrees as in Fig. 7. When whetting a short beveled edge, such as that on the mortising chisel, it's a common practice to hold the bevel flat on the stone as in Fig. 6. Avoid rocking the blade as the whetting strokes are made, as otherwise the effect will be to form several bevels as in Fig. 5. Gouges with inside and outside bevels, Fig. 10, are sharpened and whetted as in Figs. 8 and 9. Inside-bevel gouges cannot, of course, be sharpened on a flat-faced grinding wheel; use only on a round-faced wheel or a taper oilstone. Both types are finished on a slipstone, Fig. 9. As a rule, grinding is needed only when it is necessary to form or reform the bevel or when the cutting edge is nicked.

Although many craftsmen skilled in handling chisels and gouges have developed methods which suit their own requirements, the techniques outlined in Figs. 13 through 26 are in common usage. Several rules apply to nearly all chisel and gouge operations: Always work with the grain. Always score gauge lines deeply when laying out tenons and matching mortises and when making round-bottom grooves or dados as in Fig. 12, also when rabbeting with a chisel as in Figs. 14 and 15. Scoring prevents the wood from breaking beyond the gauge line when cutting out the waste.

To get a neat job of rounding a corner, make the light chip-raising cuts A in Fig. 23. Note also the chip-raising, or chip-breaking cuts being made in Fig. 21. These chip-breaker cuts prevent splitting of the stock and make it easier to remove waste. When forming a tenon of any size or type make scorings as in Fig. 16 and shoulder cuts, Fig. 17, first. Then, if the wood is straight grained, you usually can lift the waste in one cut from each side as in detail A, Fig. 26. But if the wood is even slightly cross grained, proceed to lift the waste in stages as in details B and C, Fig. 26. Always work from both edges of the stock. Finish with the paring chisel. ★★

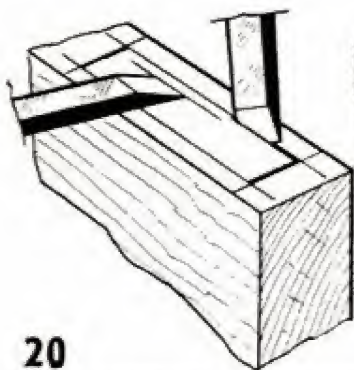
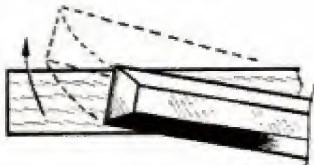


18

PARING CHISEL MAKES
SHEARING CUT WHEN WORKED
IN RECESS

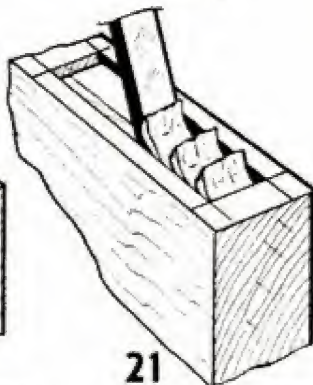
19

WHEN FINISHING TO
LINE, HOLD CHISEL AT
ANGLE AND MAKE
SHEARING CUT IN
DIRECTION INDICATED



20

WHEN MORTISING, MAKE SCORING
CUTS ON GAUGE LINES FIRST



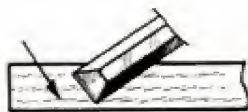
21

MAKE DEEP, CLOSELY SPACED
CUTS TO REMOVE WASTE



22

OR, BORE ROW OF CLOSELY
SPACED HOLES TO REMOVE WASTE.



23

FOLLOW SWEEP OF CURVE WHEN
ROUNDING CORNER OF STOCK



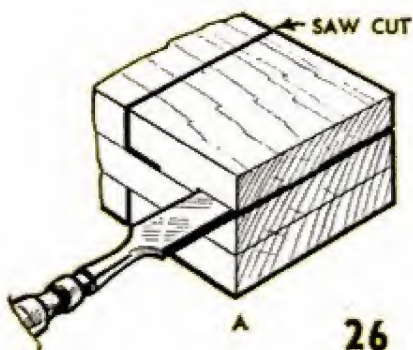
24

WHEN PARING ACROSS GRAIN
MAKE SHEARING CUT



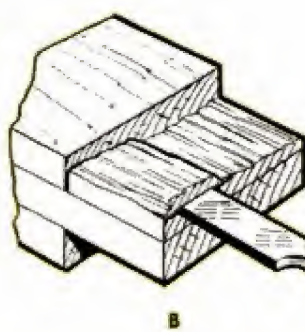
25

CONCAVE CUT CAN BE MADE BY
PRESSING DOWN AND PULLING BACK
SIMULTANEOUSLY ON CHISEL HANDLE

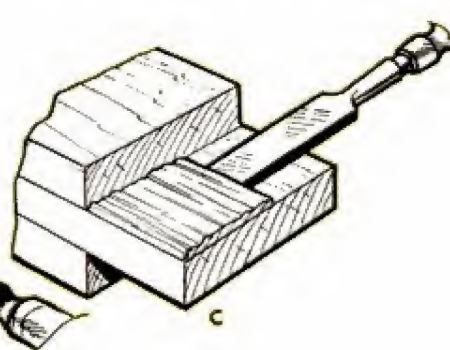


A

26

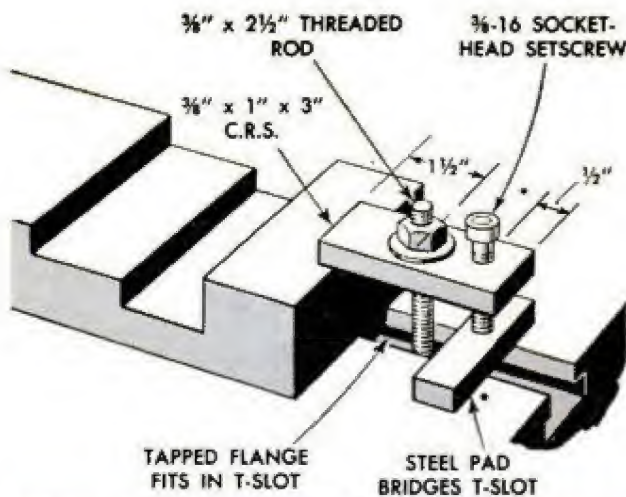


B



C

THREE STEPS IN REMOVING WASTE FROM TENON



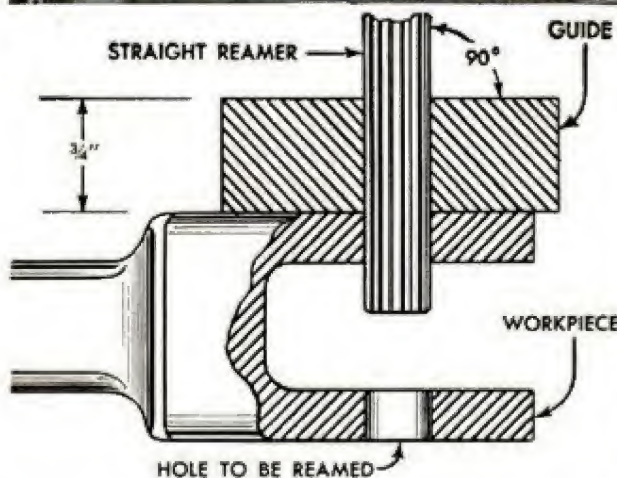
Strap Clamp Adjusts for Height

When setting up work on a milling machine or drill press it's nearly always handy to have at least one strap clamp that can be adjusted quickly to the desired height. This one fills the requirement. You make it yourself to suit the work. All you need are a jaw of C.R. steel, a threaded rod, a socket-head screw, a flange to fit the T-slot and a small steel pad on which the end of the socket-head screw can be surfaced. Assemble these parts and you have a strap clamp that can be adjusted through a wide range and one that holds positively when tightened.—William Siry



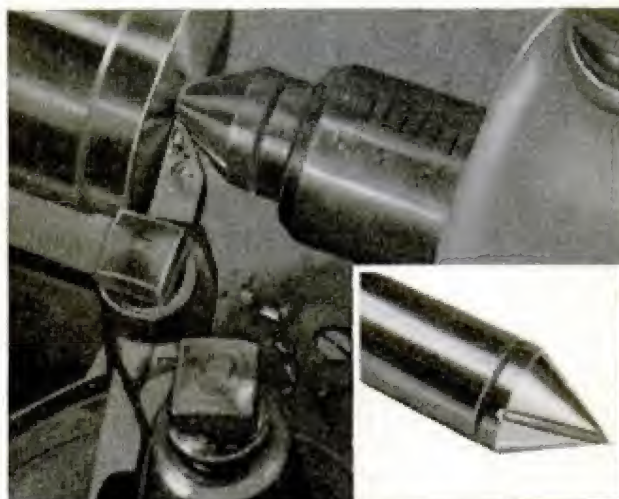
Spray-Oiling Rustproofs Tools

Few machine owners and operators like to spread a protective oil coating on bright machine parts with finger tips, an oily pad or a brush. It's a messy job and rarely do any of these methods get the oil on all the bright parts. Some are never reached with the protective film. One way to make the job much easier and far more thorough is to use a sprayer and container of the type supplied with window-cleaning solutions. This unit will handle light lubricating oils nicely and the spray will reach every part of the surface being coated.—H. Hanscom



Simple Guide Aligns Hand Reamer

In hand reaming holes in the two machined arms of a small yoke one job shop had trouble holding the finish ream within the specifications. A check of the hole alignment after reaming classified too many of the yokes as rejects. After much experimentation it was found that a block of steel machined all over, then drilled and reamed and hand-held on the machined outer surface of the arm did the trick, enabling the operator to start the reamer true. After that the holes came well within the specifications.—Frank LaSaracina



Full Face-Off Without Burring

It's difficult to fully face off the end of work mounted between centers in a lathe without forming a burr at the edge of the center hole. If you force the tool, you may shift it axially into the work and form a cavity, or concave. A full facing cut can be made easily if you grind a shallow V-groove on the bevel of the tail center, using the corner of a dressed grinding wheel. After grinding de-burr the edges of the vee. As you see in the illustration, the groove allows the tool point to be fed past the edge of the bearing surface in the center hole.—H. J. Gerber



Drill Chuck on Straight Shank Permits Power Feeding

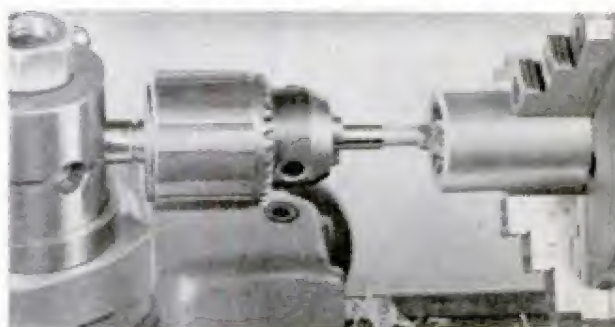
BY MOUNTING a drill chuck on a straight shank you can set it up in a block-type tool holder for accurate, power-fed drilling and reaming in the lathe. The method saves time on repetitive work, minimizes breakage and, due to the use of power feed, gives greater wall uniformity in both drilled and reamed holes. The use of power feed also is especially helpful when drilling and reaming tough metals. When using the tool post as a holder it is necessary to locate the holes in the post on the center line, or axis, of the lathe. To do this, a center-drilled round is locked in the chuck and the chuck

and shank are mounted between centers, the tool-post bolt being left slack so that the parts won't be under tension. Shim the tool post if necessary. Or, if the tool post is too high, determine how much must be turned off the lower end. This will not affect its use for holding boring bars and other round-shank tools and once centered it is easy to relocate it. A drill chuck fitted with a straight shank and mounted in a block-type tool post in this manner also is useful in certain special lathe operations involving use of very small boring and internal threading tools.—H. J. Gerber

ACCURATE DRILLING of large and small-diameter holes is possible with chuck mounted on straight shank



CHUCK MOUNTED on straight shank permits use of carriage power feed for true reaming of drilled holes

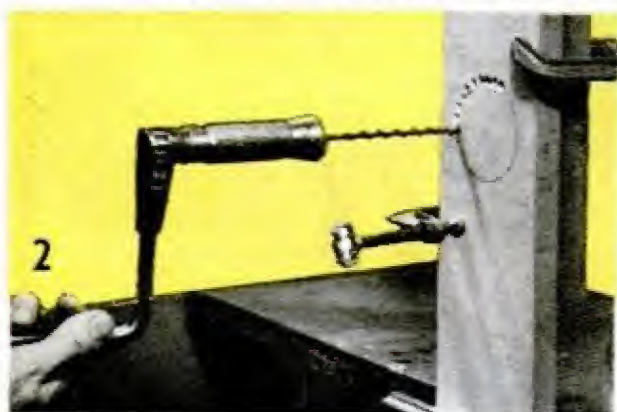


Shop Projects 1961

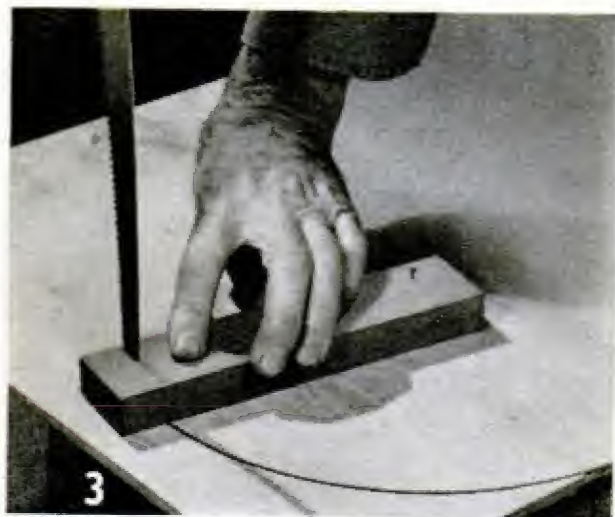
IN-AND-OUT CIRCLES

are easy to cut accurately
with both hand and power
tools by using these methods

By Walter E. Burton

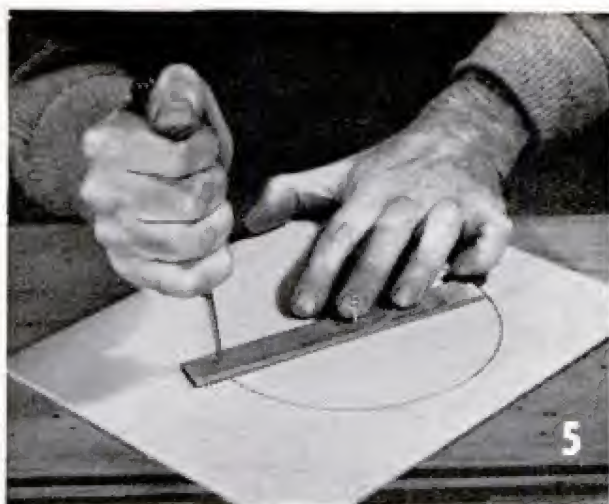


WITH NO OTHER, FASTER MEANS at hand you can form disks or circular openings by the method above. After drilling holes, finish edges with rasp. Below, circular cut is made with keyhole saw and pivoted arm



WHEN YOU need a disk or a round opening cut more accurately than you can do freehand, the problem is how to do the job simply and quickly with whatever tools are available. You wouldn't use the method shown in Fig. 2 except in an emergency or when no other means were available for cutting an inside or outside circle. However, you can produce a very accurate disk or inside opening by smoothing the surfaces to a gauge line with





USING A PIVOTED ARM, or sweep, similar to that pictured in Fig. 3, you can make accurate circular cuts in many soft materials with ordinary pocket knife

a rasp after the hole drilling has been completed around the circumference. By using a pivoted arm, or sweep, as in Fig. 3 you can cut a very accurate circle, inside or outside, with an ordinary compass saw or keyhole saw. The arm is detailed in Fig. 13. Working in much the same manner and with the same type of arm, you can cut a true circle as in Fig. 5, using an ordinary pocket knife. It is, of course, difficult to make circular cuts in wood, even very thin wood, with the pocket knife, but cardboard, heavy paper, linoleum and similar soft materials can be cut accurately. The knife blade must be ground thin and the edge formed with a long bevel for this work.

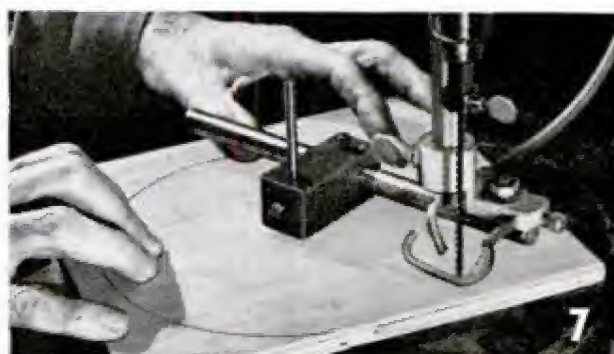
If you have a portable jigsaw, you can easily make a circle-cutting jig, or sweep, to work as in Fig. 4. A sweep suitable for most jigsaws is detailed in Fig. 13. Many portable jigsaws can be fitted with an accessory jig made especially for the purpose. Accessory circle cutters also are supplied for stationary jigsaws, an example of this type of circle-cutting jig being shown in use in Fig. 7. Making circular cuts with power tools and accessory jigs is, of course, fast and more accurate than any hand method, as the problem of keeping the edges of the cut square is automatically taken care of by the right-angle position of the power-driven blade.

Circle cutters made for use in the drill press as in Fig. 6 will do accurate circle cutting in harder materials such as fiber, plastic and sheet metals. Measurements must be made carefully and the setting of the cutter checked closely to assure accurate work. Care must be taken also to adjust the rate of feed to the type of materials being cut, as otherwise tearing and chipping of the edges may result.

Often a gasket cutter of the type pictured in Fig. 8 comes in handy for cutting



CIRCLE CUTTER on drill press will cut circles in hard-board, fiber, plastic, soft metals. Below, accessory circle jig in use on stationary jigsaw. Cuts true circle



GASKET CUTTER does good work on materials such as leather, artificial leather, cardboard. Below, for true circles, perfect round openings, use lathe



small-diameter circles in soft materials such as thin cardboard, tooling leather, also artificial leathers, thin plastic and similar materials. You also can use a sewing machine to "cut" many of these materials as in Fig. 11. The closely spaced holes made by the needle in thin materials make a very neat, accurate tear line. A simple turning jig can be made from cardboard and a brad.

Tools not normally used for circular cuts in wood can often be made to serve this purpose. An example is use of the hole saw, Fig. 10. Here it is used to cut a round opening in plastic-faced plywood. Ordinarily, this tool is driven by a portable electric drill, but it works equally well, although slower, when driven by a bit brace.

A router bit mounted in the drill press does an acceptable job of cutting a circular opening in wood. You'll need a pivot, of course, on which to turn the workpiece. This can be improvised from a piece of hardboard or plywood large enough to support the workpiece as it is turned about the pivot. The latter can be a small nail inserted in a clearance hole center-drilled through the workpiece. Tap the nail into the supporting piece and clamp to the drill table. The cut should be made successively, running only about $\frac{1}{8}$ in. deep at each pass.

If you must have a disk or opening as near perfectly round as is possible in wood, then chuck the work in a lathe as in Fig. 9. Or, you can do very nearly as accurate a job with a simple setup on a circular saw as in Fig. 1. Rough-cut the disk just outside the pattern line, then center it on a pivot and finish the job with the saw. Use a blade with wide set and make the final cut slowly.

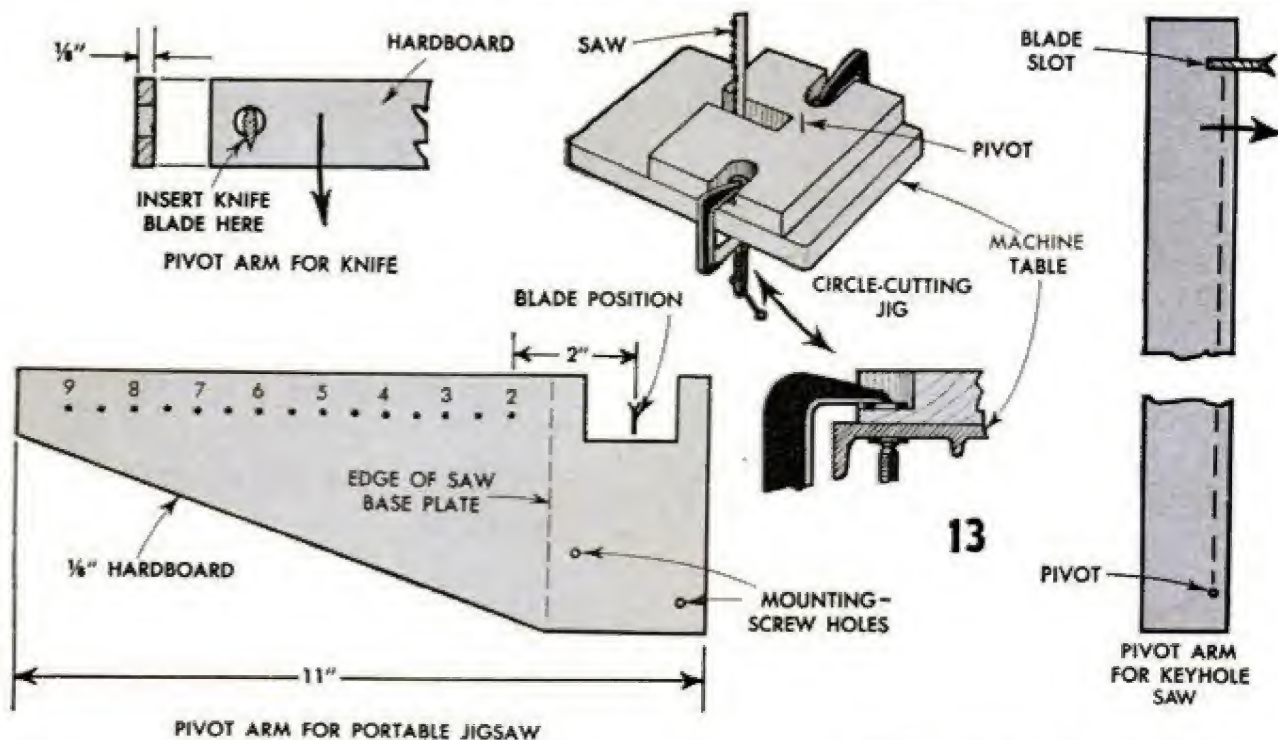
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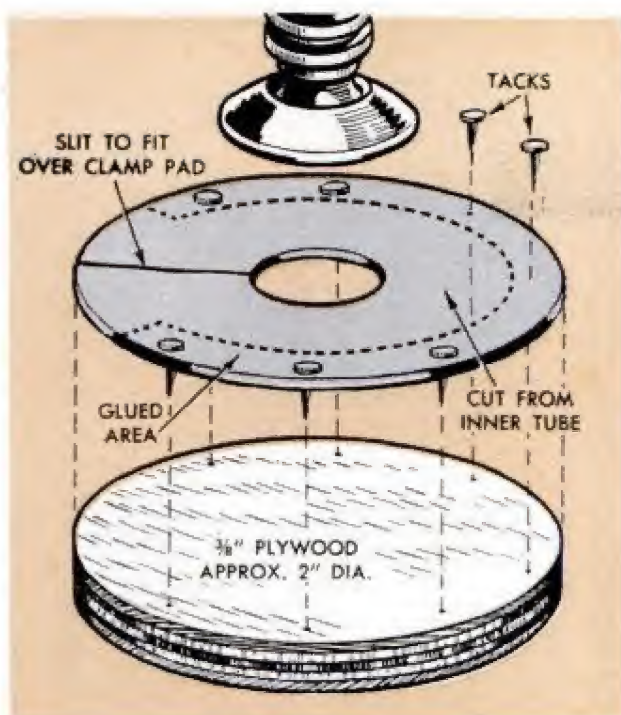


HOLE SAW cuts round openings in harder materials such as plastic-faced plywood, hardboard, metals



USE SEWING MACHINE to perforate a tear line in soft materials. Quite accurate work is possible. Below, router bit being used to cut round opening





Detachable C-Clamp Pads Save Work Surfaces

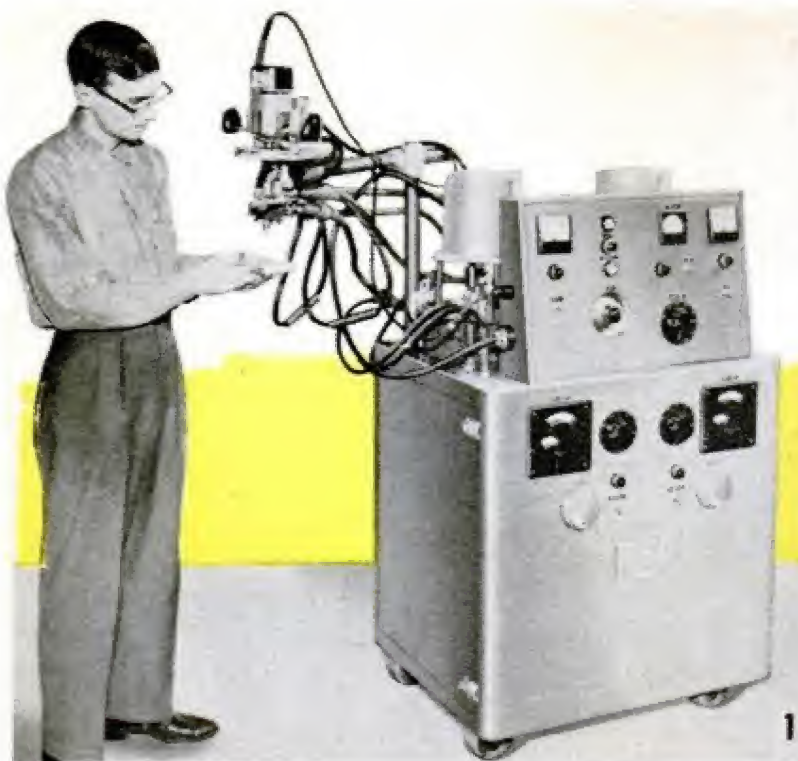
Not only do these clamp pads prevent damage to work surfaces, they also save the time and trouble of holding the pads in place while tightening the clamps. A pair of the pads is made for each clamp when you are preparing to assemble parts that must not be marred or dented. Each pad is made from a disk of plywood to which is attached a disk cut from an innertube. The latter is slit from one edge to a center hole so that when tacked to the plywood disk the assembly slips over the clamp pads. Tension of the rubber disk will hold the pad

in place while the clamp is tightened or loosened. Although the diameter of each pad is given as 2 in. they can be made any convenient size, and for the larger C-clamps the plywood disks should be cut from $\frac{1}{2}$ or $\frac{5}{8}$ -in. material. For maximum protection against damaging the surface of the work, glue or cement a disk of rubber to the face of the plywood disk. Although the pads are detailed as disks, they also can be made square in larger or smaller size as the job requires. A square pad is often an advantage.—H. Hanscom

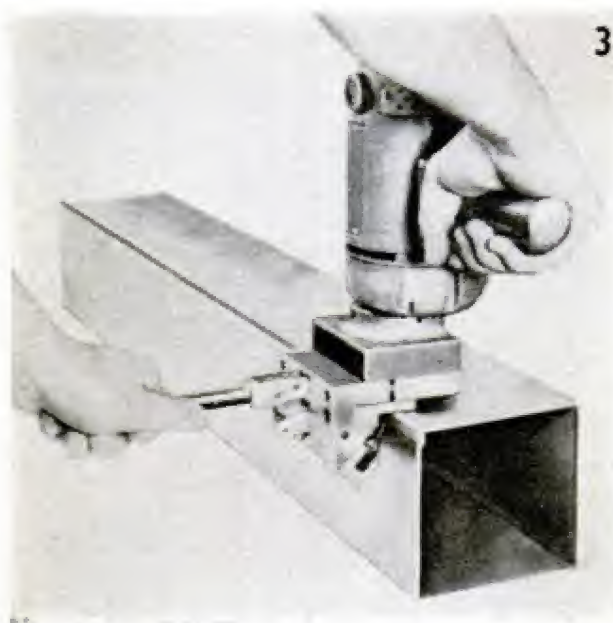
U-Shaped Cutoff Stop Fits on Rip Fence

When cutting duplicate workpieces to length on a circular saw the usual practice is to clamp a stop block to the rip fence at a point far enough ahead of the blade to permit the stock to clear the block before being cut off by the blade. This U-shaped "block" serves the same purpose and does away with the necessity of assembling the usual C-clamp and block each time cutoff work is to be done. It can be made from plywood as indicated, or from solid stock if you prefer, and should be dimensioned to fit the fence snugly. You'll have to determine the overall dimensions yourself, working from the ripping fence on your saw. Normally the block should be about 3 in. long.





SHOPPING FOR TOOLS



3

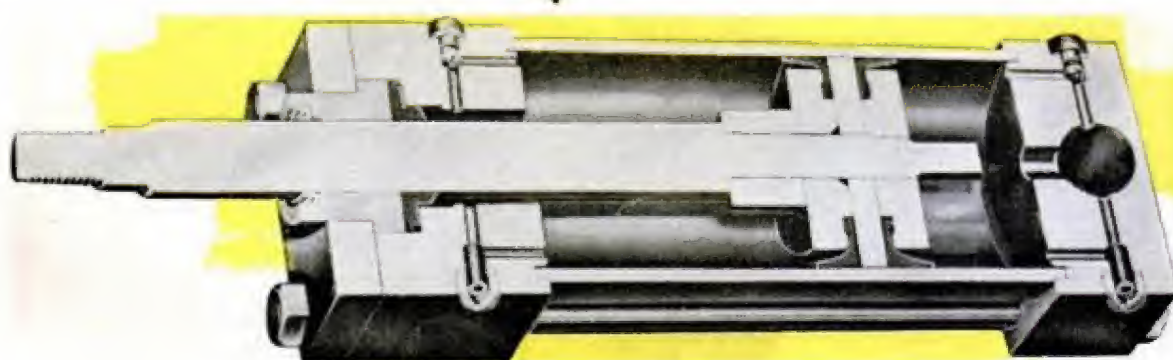
1. FOAM PRODUCING UNIT is self-contained and is capable of pumping, metering and mixing formulations for rigid, semirigid, flexible foams. Meets requirements of research, foam-development laboratories
Martin Sweets Co., 114 S. First St., Louisville 2, Ky.

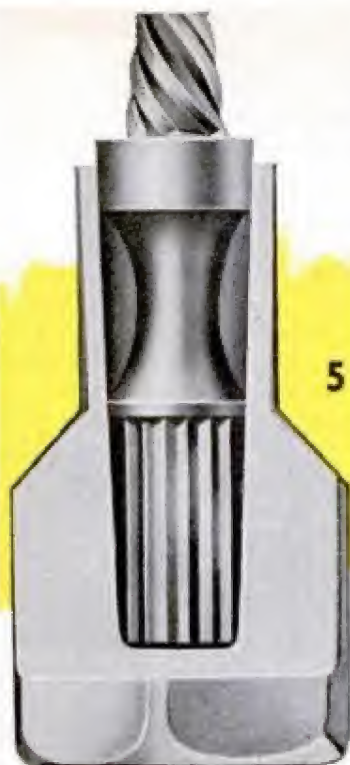
2. NEW BUFFING WHEELS, or mops, are designed for jewelers, silversmiths, craftsmen in metals, and for school shops. Dense cotton-tufted wheels give maximum efficiency and wear and produce fine finishes
Crafttools, Inc., 306 Broadway, New York 13, N. Y.

3. ELECTRICALLY DRIVEN SEAM ROLLER for tinmiths rolls a perfect lock seam at rate of 18 to 30 ft. per min., speed depending on gauge of metal. With accessory equipment handles metal from 18 to 28 ga.
Millers Falls Co., 57 Wells St., Greenfield, Mass.

4. AIR CYLINDER combines a simple, rugged mounting with new operational features. Designed with one flange plate extending, extension fitting into groove milled in machine pad. No pins or dowels required
Miller Fluid Power Div., Flick-Reedy Corp., York and Thorndale Bldg., Bensenville, Ill.

4





5. SCREW EXTRACTOR is so designed that, should it break in use, it will break at a point above shoulder shown in cutaway view. Thus a portion of extractor remains above surface so that it is easily removed
 Roddick Tool Co., 1023 Pauline St., Anaheim, Calif.

6. MAGNETIC TIRE SHIELDS simplify the ticklish job of spray-painting auto and truck wheels. Shields, or masks, snap into place and are held by permanent magnets. Made of galv. sheet metal. Are easily cleaned
 Temple Tool Co., 3516 Imperial Highway, Lynwood, Calif.

7. NYLON DRILL SLEEVE puts drill bits with broken tangs back into service. No turning down or other preparation necessary. Sleeve slips right over damaged tang, or shank, fits into tapered drill spindle
 Rick, Inc., 2630 West 12th St., Erie, Pa.



8. SLOTTED STEEL ANGLE is available with accessories for building storage racks, partitions, special stands. Comes regularly in 14-ga. and in heavy-duty 12-ga. steel. It's available in 6, 7 and 8-ft. lengths
 Lyon Metal Products, Inc., 22 Plant Ave., Aurora, Ill.



9. NON-CLOGGING FILE for auto-body work and filing soft and hard metals such as aluminum, copper, steel and cast iron; can also be used as rasp on hard and soft woods. Handle is adjustable to two positions
 Gordon Associates, Inc., Derby, Conn.



LEFT-HAND



RIGHT-HAND

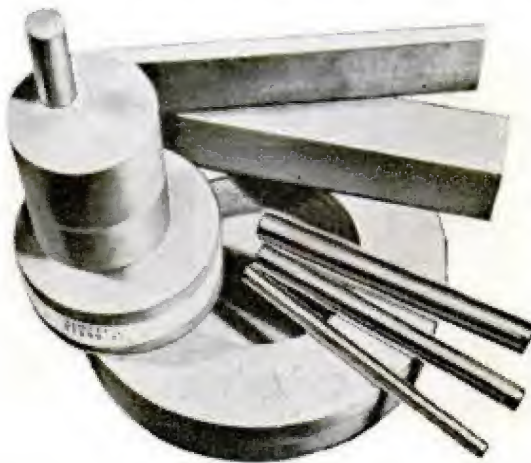




10

10. RIP-FENCE EXTENSIONS give this table saw a fence-to-blade capacity of 49 in. Fence extensions ordinarily are used without table extensions on large panels but for supporting long boards table extensions, or wings, also are available. Saw takes blades up to 10 in. in dia. and can be supplied with motors up to 3 hp.

Boice-Crane Co.,
943 W. Central Ave., Toledo 6, Ohio



11

11. STEEL-BONDED CARBIDES can be machined with conventional tools, thus giving designers and engineers a versatile, machinable carbide in the stock forms of rounds, squares, disks and other shapes. From these tools and other items may be fashioned for use where high heat, wear and corrosion resistance are essential

Sintercast Div., Chromalloy Corp.,
132 Woodward Ave., Yonkers 2, N. Y.

12. STEPLADDER, STAIR LADDER and extension ladder—it's all three in one light unit. Six-foot ladder extends to 10 ft., or, when used as stepladder, it can be adjusted easily for use on stair steps as in the smaller views. Comes in 6 to 10-ft. stepladder sizes. Of all-magnesium construction it is corrosionproof

White Metal Rolling & Stamping Corp.,
443 4th Ave., New York 16, N. Y.



12



13. FINGER-TIP WRENCH enables user to reach a bolt head or nut in any space into which a finger can be inserted safely. It's made from stainless steel so that it will not rust and comes in individual sizes or as a complete set with a range of $\frac{1}{4}$ to $\frac{3}{8}$ in. The thimble, or cot, is adjustable to fit comfortably

Beaver Tool Co.,
P. O. Box 256, Huntington Station, N. Y.



13

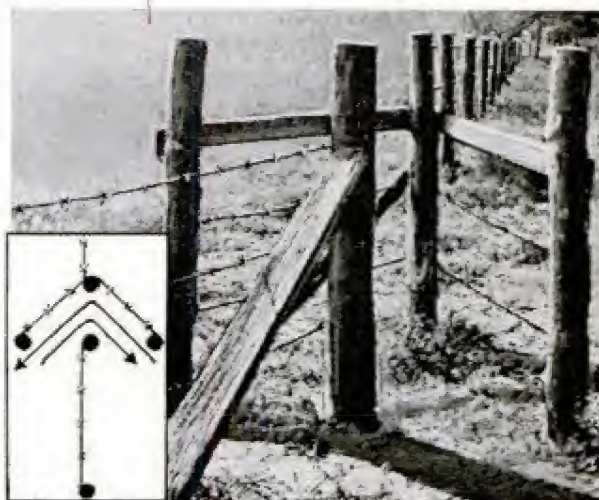
Hot Wire Divides Feed Bunk

Cattle won't compete for feed across the width of this bunk which, in effect, is separated into halves by a hot wire energized by an electric fence controller. The arrangement assures that each animal gets its fair share of silage or other feeds which have been uniformly distributed by the unloader. Stronger and more energetic animals are effectively restrained from reaching beyond the center of the bunk. The wire is carried on standard electric fence posts cut to required length and anchored in the bottom of the bunk.



V-Gate Built Into Wire Fence

V-gates, or walk-throughs, are a convenience in any wire fence where free passage from one fenced area to another is frequently necessary. The gate is made by arranging the posts as in the inset detail, the space between being made sufficiently wide to permit a person to pass through easily. Anchor posts should be braced as in the photo to prevent sagging of the wires along the length of the fence. Note that the angle of the three posts which form the Vee is about 90 deg. or slightly less to assure that cattle and horses cannot pass through the gate.—V. and G. Russel



False Guard Bars Fool Cattle

The four-bar cattle guard pictured soon proved inadequate as the more venturesome animals, tempted by lush grazing on the opposite side, found they could jump over the existing guard quite easily. Rather than install a swinging gate, the owner painted stripes of uniform width on the surface of the blacktopped lane, spacing the stripes the same distance apart as the guard bars. Thereafter cattle would not attempt to cross the guard as long as the stripes were kept painted so that they were well defined.—Wayne Floyd



Pipe Posts for Feedlot Fence

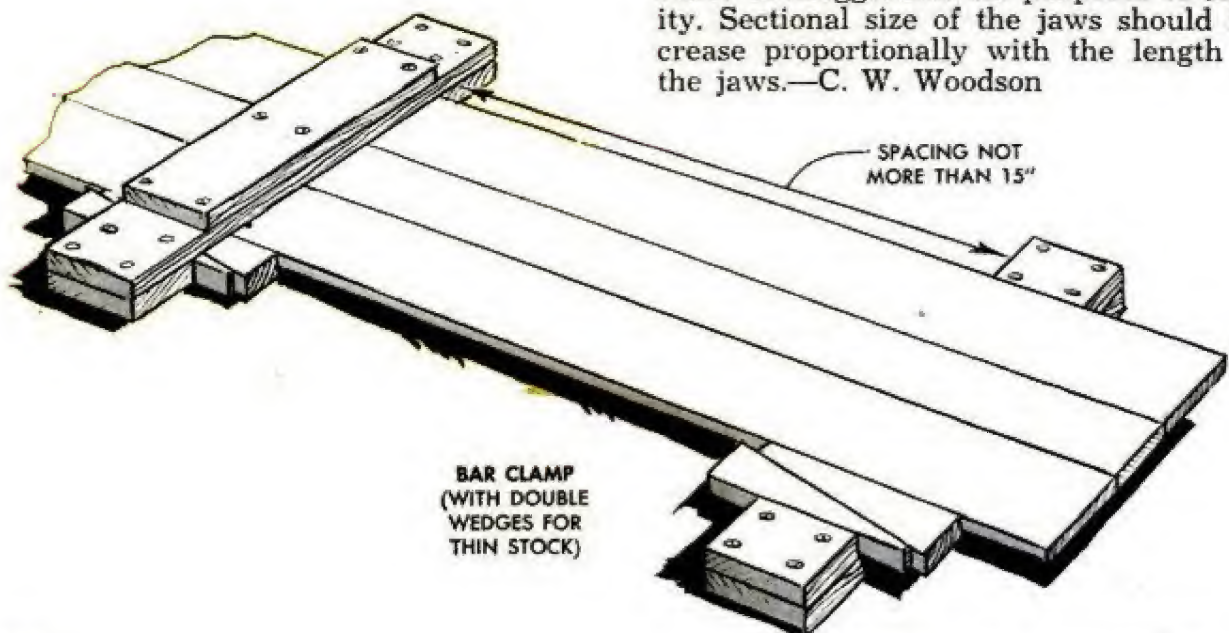
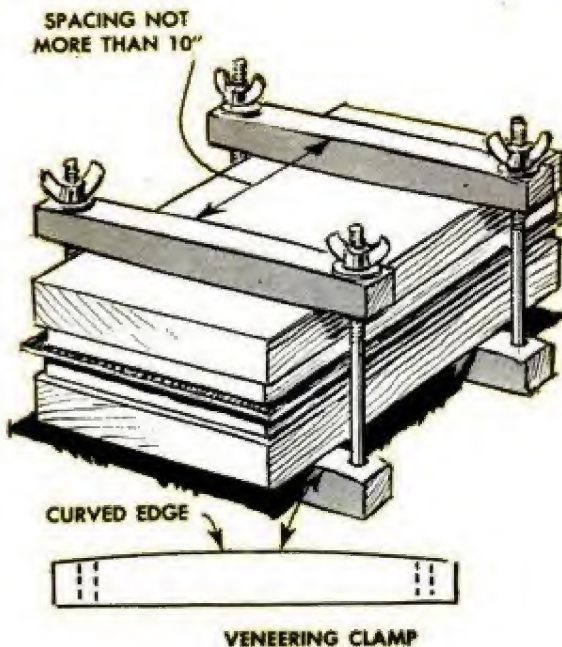
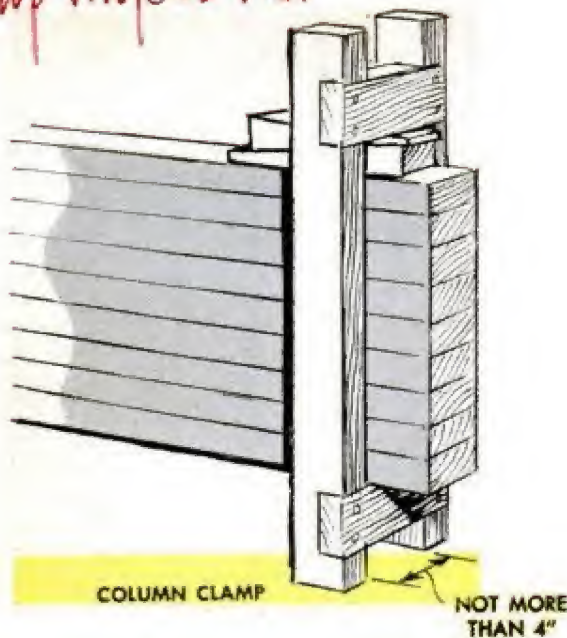
Lengths of heavy 2½-in. pipe set in concrete support this feedlot fence. The pipe posts also are filled with concrete to prevent them from filling with rainwater. The board fence is built up by nailing 1 x 8s to 2 x 8 cleats, the latter spaced on 6-ft. centers to match the spacing of the posts. After the fence sections have been assembled in the horizontal position and painted, they are raised to the vertical position and are attached to the posts with ¾-in. U-bolts, one bolt being placed at the top and bottom of each post as indicated.

—A. M. Wettach



SEVEN SHOPMADE WEDGE CLAMPS

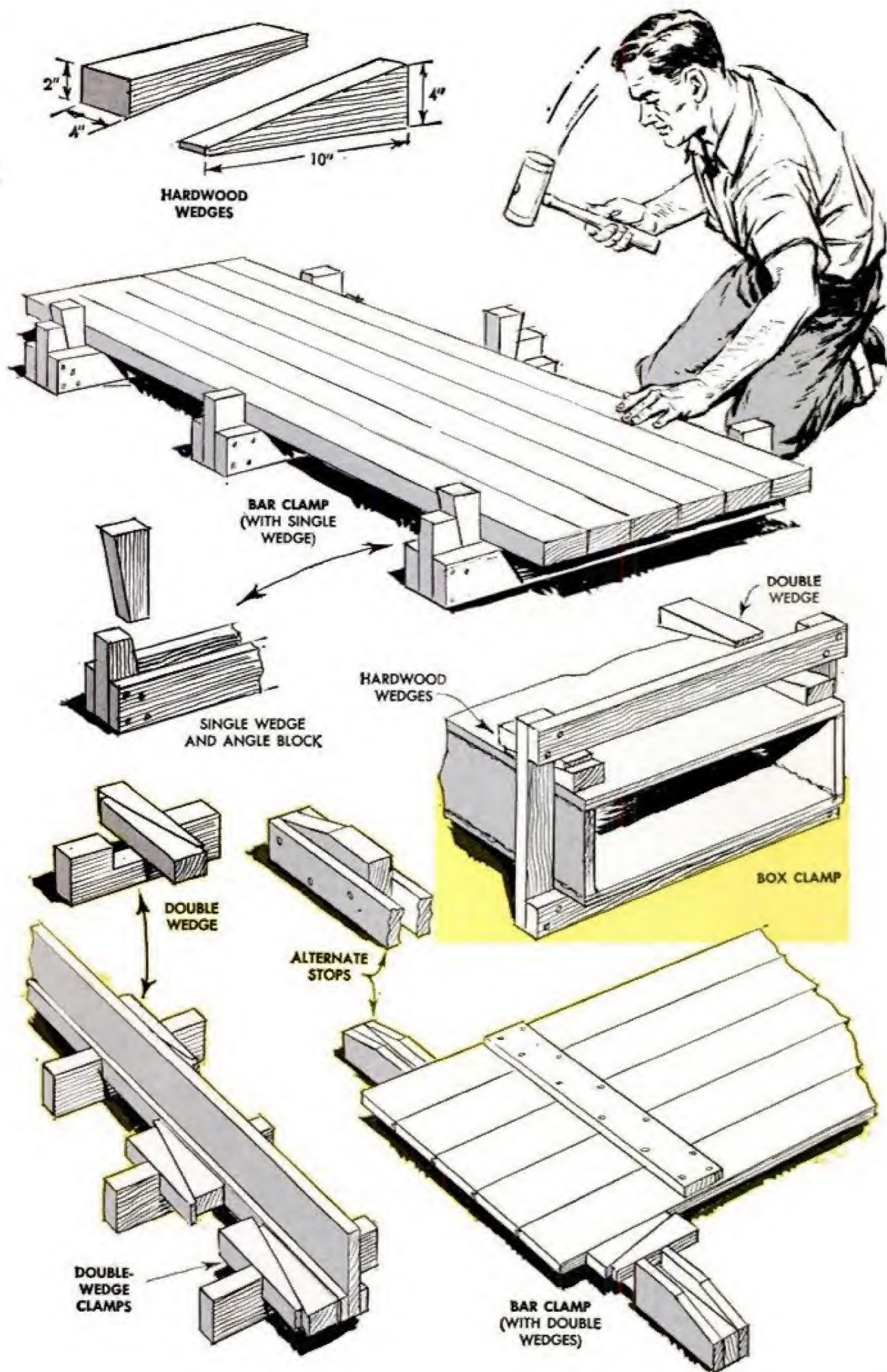
bring pressure to bear on heavy gluing jobs

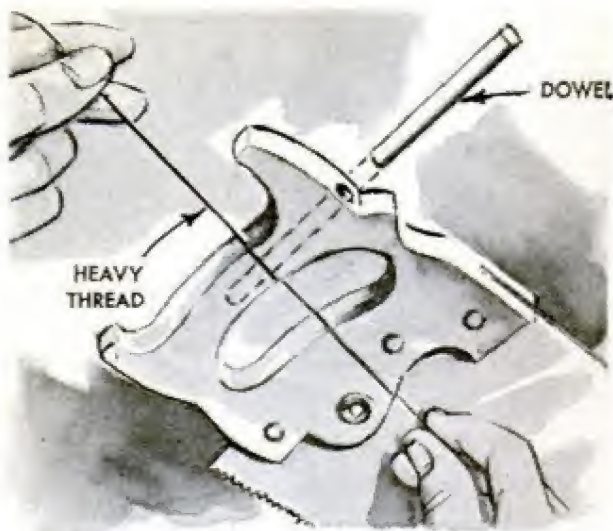


THESE CLAMPS have the advantage of being made to order for the job. They're inexpensive, too, as nearly all the types shown can be made from sound, rough stock and the wedges cut from a hardwood, such as oak. As detailed, the wedges are an average size. You can make them larger or smaller as the job requires. Fixed jaws of the bar clamps are wide and do not indent edges of the stock being clamped. This makes extra padding blocks or strips unnecessary on average work. The heavier bar-clamp unit with a single wedge, detailed on the opposite page, is especially effective when gluing up heavy stock, such as 2 x 4s for a bench top. Any of the bar clamps shown can be used for clamping narrower widths simply by inserting filler blocks between the wedges and the edge of the stock being clamped.

One does not often have use for a box clamp or a column clamp, but when needed they can be assembled quickly and in any number of duplicate units required by the job. Units will be stronger if you assemble the parts with screws and glue.

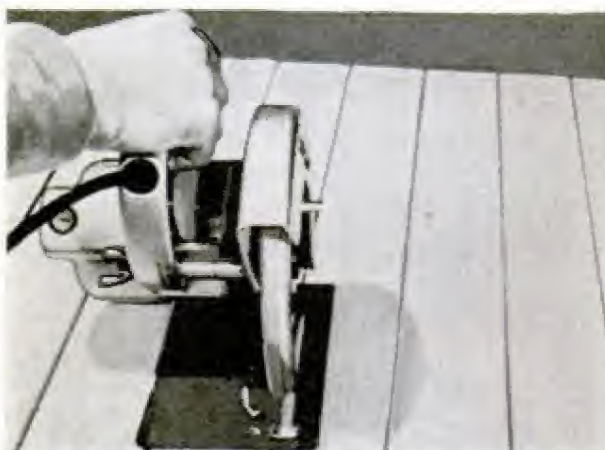
Note that one edge of each jaw of the veneer clamp is curved. Purpose of this is to cause each jaw, or bar, to exert uniform pressure across the full width when the wingnuts are tightened. The face of the jaw can be curved sufficiently by planing lightly from each end. In the detail, the curve is exaggerated for purposes of clarity. Sectional size of the jaws should increase proportionally with the length of the jaws.—C. W. Woodson





Thread Spreads Glue Evenly

Working glue into a crack or split when making a repair can become a baffling problem unless you know the trick of using a length of thread or cord to spread it uniformly on the meeting surfaces. There's no need to open the crack or split wider unless it's less than thread width. Just lay a thin line of glue over the opening, then, holding both ends of the thread, work it into the crack with a back-and-forth motion. It takes the glue right along with it. You may have to make a second application of glue and repeat the performance to cover the surfaces completely. Clamp the work until dry.—Robt. L. Sargisson



Saw Kerfs Release Warp Stress

One effective way to prevent or correct warping of a wide panel is to run spaced saw kerfs across one face, the depth equal to about half the thickness of the stock. This has the effect of relieving stresses set up across the width of the panel by expansion of the wood fibers. In the case illustrated, warping of a sliding tailgate on a farm truck made raising and lowering very difficult. Here the saw kerfs were run along the tongue-and-groove joints of the boards to relieve stress.—Ken Hadenfeldt



Drill Bit Lifted With Pliers

When drilling hardwood with a small twist drill the bit sometimes fills with fine chips and binds tightly in the hole. Simultaneously the chuck on your hand drill lets go. Getting the drill bit out of the hole without breaking or bending it can become quite a project, unless, of course, you remember this simple method. Locate a suitable block of wood, place it close to the bit and then grip the shank of the bit with pliers resting on the block. Ease the bit out of the hole with a series of short lifts with the pliers.



Grooved Block Holds Steel Wool

One of the discomforts that seems to go along with working with steel wool is the tiny steel slivers that work their way into the fingers and palms of the hands. They can be quite painful. I tried a number of ways of overcoming this problem but none has worked out as well as the kerfed wooden block pictured. Use a rectangular block of a handy size. Run saw kerfs crosswise and to a depth equal to about half the thickness of the block. Then press the steel wool into the kerfs as pictured.—Benson E. Hall

Stereo Goes Back on Tape



By Art Zuckerman

THOUGH THE AVERAGE phonograph owner probably doesn't know it, stereophonic sound didn't begin with the stereo record. This wonderful disk put stereo on the map, but tape had put it on the road much earlier.

It all began when some bright recording engineer observed that home recorders use two tracks, recording on one side and then on the other after the reel is flipped. Instead of using the tracks one at a time for that same old monophonic sound, this genius reasoned, why not add an extra tape head to the recorder? That way you could use two microphones spaced apart and put their pickups on each track at the same time. Thus you would create the full-dimensional effect the world today knows as stereo.

This innovation coincided with a dramatic improvement in tape heads, an improvement that made possible the captur-

ing of the entire audible range of sound on tape running at the home recorder's top speed of $7\frac{1}{2}$ i.p.s. Up to then, only a 15-i.p.s. speed could record clean up to 15,000 cycles.

The combination of top-quality recording at home-economy speed, plus the two-channel recording technique made stereo the tape industry's new byword. It was almost impossible to buy a recorder that wouldn't play commercially recorded stereo tapes.

If this earlier stereo tape was so great, why didn't it revolutionize the recorded-music business the way two-channel platters did later on? First, because tape recorders are a pretty stiff investment for the average customer. Second, because the commercially prepared stereo tapes were themselves expensive.

A standard seven-inch reel with 1200 feet of tape plays monophonically for an



Left, RCA home tape machine plays RCA $3\frac{3}{4}$ i.p.s. tape cartridges. Below, Tandberg system boasts outrigger recording amplifier. This Norwegian unit has dual playback amplifiers and one built-in speaker which can be applied to either channel 1 or channel 2. The microphone for channel 2 record is plugged into the external recording amplifier



hour at $7\frac{1}{2}$ i.p.s., half an hour on each side. Use the second side, or track, for the extra stereo channel, and you've cut playing time in half. So half-track stereo tapes generally cost two to three times as much as monophonic phonograph records.

When the stereo disc finally arrived with its one hour of playing time, the half-track stereo tape really took a beating. Only the confirmed audiophile was willing to stick to his stereo-tape guns. He knew tape sounded better than the stereo records, with greater tonal range, smoother response, and freedom from pops and clicks. But price talks, and though half-track tape still offers the finest stereo listening available, the commercial-tape producers saw the disc grooves on the wall, as it were.

It took the recent development of four-track tape to save the day for them. While it's done nothing to reduce the price of the recorder itself, it has given stereo tape twice its old playing time, so it can now compete pretty closely with the minute-for-minute cost of stereo discs. Best of all, quarter-track tape at $7\frac{1}{2}$ i.p.s. is almost as good in quality as half-track tape. So it is better sounding than today's stereo records.

As a matter of fact, in one important respect quarter-track tape at $7\frac{1}{2}$ i.p.s. is even better than half-track. Quarter-track is less susceptible to cross-talk problems. In half-track, the heads are stacked one above the other and, since together they

take up the entire tape width, they're immediately adjacent. As a result, there's some slight tendency for part of the channel 1 material to seep into channel 2 and vice versa, especially during recording. This is known as cross talk.

Quarter-track heads together take up only half the tape width. Therefore they can be and are spaced an entire quarter track apart, in this way virtually eliminating cross-talk.

Quarter-track stereo tape has one advantage records will never be able to match. You can make your own stereo recordings on it with many of the machines now available. This means you can borrow a friend's stereo disc and copy it on tape, or you can record an AM-FM stereocast from radio. Since the price of virgin tape is much lower than that of a phonograph record, this provides you with music at a substantial saving. And it's completely legal so long as you don't sell the copies you make.

Of course, with a machine that records quarter-track stereo, you can also make your own live stereo recordings. Furthermore, if you elect to use a quarter-track recorded monophonically, you can put two full hours of the highest quality music reproduction on a mere 1200 feet of tape!

Quarter-track stereo recording is a feature of many tape recorders offered by such companies as Ampex, Bell, Ferrograph, Norelco, Pentron, Roberts, Sony, Tandberg, Telectro, Uher, V-M and Web-

Unique stereophonic microphone manufactured by Norelco is actually two microphones in one. The top markings indicate the mid-point between the channels and the louvered openings along the sides of the microphone provide sound entry to the operating elements. To make monophonic recordings, turn the unit so that the side marked "left" faces the source



Uher Stereo III boasts push-button controls for the selection of either stereophonic or monophonic channel 1 and channel 2 recording. A similar arrangement located on the opposite side of the tape deck selects playback modes in the same fashion. A utility speed of $1\frac{1}{8}$ i.p.s. is also provided where tape economy possibly may be an important factor



cor. Other machines permit half-track stereo recording plus quarter-track playback. American Concertone is one that works that way.

On some of the new quarter-track machines, only quarter-track recordings can be made. This is true of the Norelco and Tandberg, for instance. Others, such as the Ampex, Roberts and Sony, have head-shift switches that make half-track recording possible, too. But any quarter-track machine can play half-track tapes.

Playback arrangements vary widely. Most of the machines on the market allow the playing of both channels through an external stereo amplifier and speaker system. In fact, some units like the basic Ampex model can't be used any other way. They have no playback amplifiers or speakers of their own.

If you insist on high-fidelity reproduction, this is the only way to do it anyway. The self-contained playback amplifiers and speakers found in even the best tape recorders don't usually produce particularly good sound.

If you want to take your recorder "on location" and monitor your tapes easily, you'll prefer machines like the Roberts that have a playback amplifier and speaker built in for at least one channel. These generally need an auxiliary amplifier and speaker for the second channel.

The Roberts requires an auxiliary amplifier-speaker unit for stereo recording as well as second-channel playback.

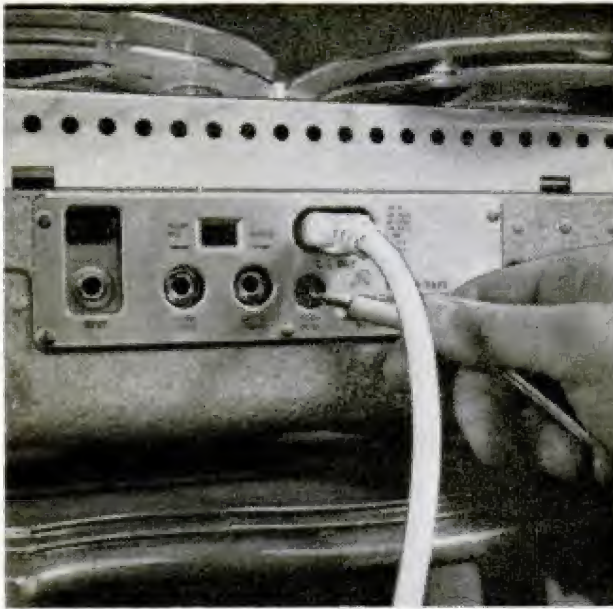
Recorders like the Tandberg need only an extra speaker to give stereo playback because they're equipped with two playback amplifiers. Some recorders, such as Norelco's Continental 400, certain Pentron and Telectro models and the latest Ampex, are completely self contained, with amplifiers and speakers for each channel included in the basic unit.

There are also some tape recorders on the market that follow the original stereo-tape pattern. They play stereo but record monophonically only.

Without question, $7\frac{1}{2}$ i.p.s. is the speed that gives the truest reproduction of music. But virtually every stereo recorder on the market today also operates at $3\frac{3}{4}$ i.p.s. Some, like Norelco, Tandberg, Telectro and Uher even provide a $1\frac{1}{8}$ i.p.s. tape speed for utility purposes where tape economy must be considered.

Let's take a close look at that $3\frac{3}{4}$ i.p.s. tape speed for a minute. Several years ago it was merely a utility speed itself, suitable mainly for voice recording. But with today's improved tape heads, $3\frac{3}{4}$ i.p.s. can deliver an easy 8000 to 10,000 cycles, and even better in some cases. This equals yesterday's top performance at $7\frac{1}{2}$ i.p.s.!

The combination of better quality at lower tape speed and quarter-track recording has led to the development of the practical tape cartridge by Radio Corporation of America. Consisting of two small reels completely enclosed in a plastic case,



Wollensak model 1616 shown here requires an external amplifier and speaker for second channel



Many tape recorders have shift levers to select either half-track or quarter-track arrangement



Fixed position heads such as on the Tandberg produce only half-track tapes and play them as well

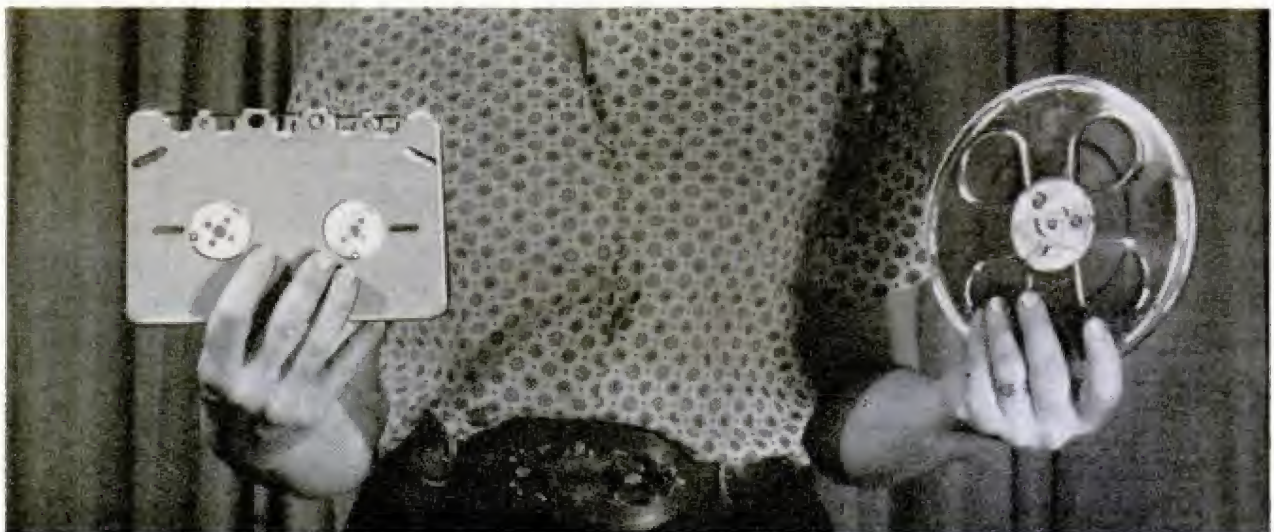
the cartridge can be used only with a special machine.

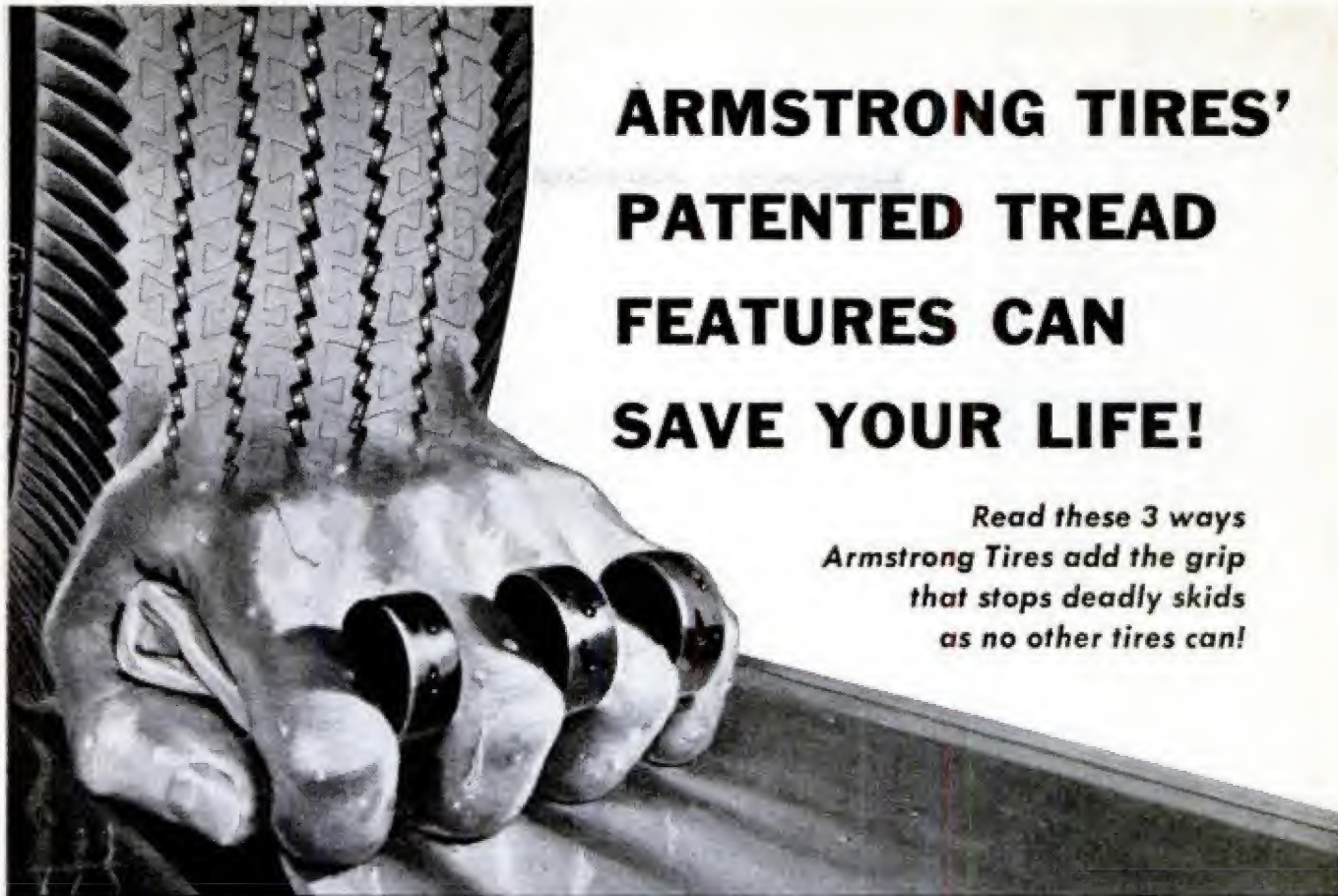
RCA has marketed such a unit, designed to record and play its own cartridges. Bell has gone RCA one better and produced a whole string of cartridge machines. The top of the line is a complete recorder, like RCA's. Then there are models that must be used with external amplifier and speaker system. One Bell offering even requires a separate preamplifier to get the music from the tape, since its only electronic part is the tape head.

Chief among the cartridge's attractions is the handling ease it offers. It's even easier to play than a record. All you have to do is put it on the machine and push a button. When the first side is through, the cartridge stops automatically. Then you pick it up, flip it over, and start all over again.

(Continued to page 216)






Blank tape cartridge by Audio Devices contains 560 feet of tape. The standard tape reel contains 1200 feet





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Armstrong Rubber Company, Home Office, West Haven, Conn.

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1) Brownie Starmatic Camera, \$29.95; 2) Kodak Automatic 35 Camera, \$89.50; 3) Brownie Automatic Movie Camera, f/2.3, \$77.50; 4) Kodak Cine Automatic Turret Camera, f/1.9, \$124.50.

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Clinic for Homemakers



As a service to our readers in solving the hundreds of problems pertaining to a home—inside or out—the editors of *Popular Mechanics* invite you to present your problems to The Clinic Editor for help and advice. Address your questions to The Clinic Editor, *Popular Mechanics Magazine*, 200 East Ontario Street, Chicago 11, Ill.

Now Is the Time To Seed and Feed Lawn



Q—I have two lawn problems. First, I live on a corner lot and the curbs are wide, that is, the distance from the street to the walks is about 15 ft. I have not been able to get grass to grow under the red maples along the curb because of the thick foliage. Second, although my lawn is not large it is old and in rather poor condition, seems to be thinning from year to year. What's the solution to these two problems?—N. R., Va.

A—We'll say at the outset that the solutions are going to require some time and labor. Take the first problem. Both the trees and the grass are competing directly for the nutrients available with the trees having the edge on the grass which must struggle for existence in day-long shade. Feeding roots of the trees (you did not say how old the trees are) draw nutrients from the top soil as well as from the subsoil. Some gardeners cut away a portion of the tree roots closest to the surface in order to give the seeding a better chance to become established. This practice may be open to some question, but in many instances it does achieve the desired result. Much depends on seasonal conditions, topography, moisture available and other local factors. In some instances the trees can be trimmed in such a way as to permit some sunlight to reach the ground underneath. Work the soil under the trees to a depth of 2 to 3 in., apply a complete fertilizer and rake into the soil so that it is well distributed. Use a shady mixture of seed, apply a moderately heavy seeding, rake lightly to cover the seed, and, if the curb slopes, cover with burlap to prevent the soil from washing away during a heavy rain. Apply a second feeding after the blades of the seedlings are 2 or 3 in. high. This job can be done in the fall or in the early spring, success at either time of sowing depending to considerable extent on the season. Usually an old lawn such as yours—we are judging from your description—needs spiking, top dressing and reseeding. A regular schedule of feeding also should be established. Spiking is done with any one of several tools made especially for the purpose. It takes time to do a thorough job, but as a rule the effort is well repaid. This done, old lawns usually are benefited greatly by top dressing with black soil to a depth of an inch or two. This should be raked and leveled to a uniform depth. Follow this with new seeding and with at least two applications of fertilizer before the coming of cold weather halts growth.

(Continued on page 214)

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Off to a vacation? Headed for a camping trip? Or just living it up in your own backyard? Whatever's ahead in outdoor fun, you'll have more fun with Coleman.

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What Causes Condensation

Q—When the temperature falls below freezing the windows in my new home sweat and water runs down on the sills and sometimes onto the floor. This happened last winter during the colder months, even though the weather was clear. We have gas heat. Could this be the cause? If so, then what is the cause and where does the water come from?—*H. J., Ala.*



A—Did you ever notice the beads of moisture that quickly form on the outside of a glass tumblerful of cold water on a warm summer day? And did you ever wonder why? The reason is quite simple. The surface of the glass is cooled rapidly by the cold water to a temperature much lower than the air which contacts the outer surface of the glass. The moisture in the air is cooled to the dewpoint and condenses on the outer surface of the tumbler, forming the beads of moisture you see. Look at the inner surface of a window pane in your home which is covered with condensate and you are looking at precisely the same thing, and for the same basic reasons. The pane is cooled by the cold outside air. The warm, moisture-laden air from inside the room contacts the inner surface and the moisture (water vapor) it contains is rapidly cooled below the dewpoint. The result is the condensation, or "sweating," that is causing your trouble. The gas-fired furnace or heater (you did not say what type of heating equipment you have) is not a cause if it is properly vented. An unvented oil or gas-fired heater is a principal contributing cause of condensation troubles as one of the products of the combustion of concentrated fuels is water vapor.

Drainage Problem

Q—My neighbor's lot is graded higher than mine and when we have heavy rains water runs off the high lot and collects along my basement wall, from where it seeps into the basement and under the basement floor. Although this drainage water does not cause any damage, I would like to find some way to keep it away from the basement wall. The high lot is terraced along the lot line and my lot is quite level from the bottom of the terrace. What do you suggest?—*R. C., N.Y.*



A—You do not say but we'll assume that the area involved is grassed over and is level each way. If these assumptions are correct then the problem is to intercept the water before it reaches the wall and drain it in one or the other or both directions from a midpoint along the wall. If there is sufficient fall, or slope, at the front or back of the lot to carry away the water once it reaches either point, then it usually is possible to use a wide and shallow waterway, or swale, to intercept the surface water that runs down the terrace slope and drain it away fast enough to prevent it from seeping below the surface and working toward the foundation wall. To do this you will have to remove the sod and then remove enough soil to form a shallow swale about 3 to 4 ft. wide and about 3 in. deep. Use a level to make sure that there is a slight slope, say about $\frac{1}{4}$ in. to the ft., each way from the midpoint of the wall. As soon as the swale has been established, replace the sod and water thoroughly so that growth can continue.

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crisp, clean beauty... and the new miracle resins are so durable they fight the effects of time and weather far longer! The result? A money-saving bonus of extra years between paint jobs!



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Stereo Goes Back on Tape

(Continued from page 208)

Of course, should you want to play only the second selection, you've got to rapid wind the first side before flipping the cartridge, just as you must with tape reels.

Another claimed advantage of the cartridge is economy. Since it operates at 3¾ i.p.s., it uses only half the tape required for quarter-track reels at 7½ i.p.s. But the cost of the cartridge housing and mechanism largely offsets this tape saving in actual practice. In fact, a cartridge containing an hour of prerecorded stereo music can cost up to \$9.95, while you can get tape on reels with the same amount of music prerecorded at 7½ i.p.s. for only \$8.95!

For the man who likes to make his own recordings, the ease of cartridge handling can prove a costly luxury. A standard blank cartridge with 560 feet of tape lists at about \$4.50. For \$3.50 you can get 1200 feet of tape on a reel. Since just about every home tape recorder has a second tape speed of 3¾ i.p.s., you can see that the cartridge actually costs more than twice as much as the reel for the same level of home recording quality.

People Skeptical

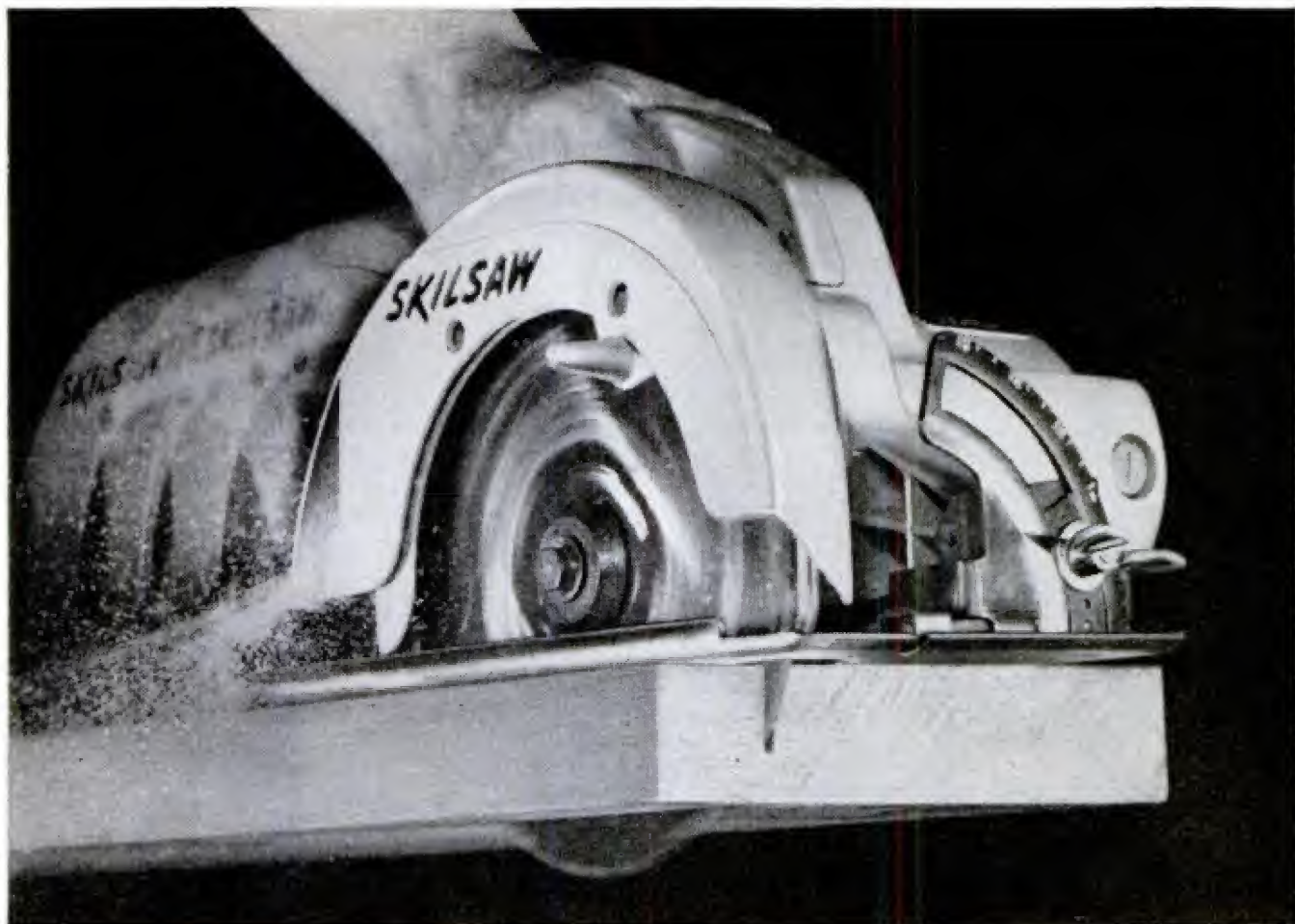
Many people are inclined to question the great improvement in handling ease you get from a cartridge, too. Just how hard is it, they ask, to thread a tape past the heads of a standard recorder and onto a takeup reel? One leading tape manufacturer, who also sells cartridges, observes that home movie makers greatly prefer roll-film cameras to cartridge types because of their economy, and roll-film cameras are a lot harder to load than the most complicated tape recorder.

As for cartridge features like the automatic end-of-tape stop, you also can get this in a number of reel-to-reel machines. Ampex, Norelco, Revere, Tandberg, Uher and many others have either tension devices that stop the transport when the tape runs out or special electric contacts that turn the machine off when shorted by a metallic leader near the end of the tape.

How about the most important consideration, sound quality?

Full-range reproduction is claimed for the new cartridges. But while all the frequencies may be there, they just don't come out as smoothly at 3¾ i.p.s. as they do at 7½ i.p.s. The low tape speed also aggravates the problem of signal-to-noise ratio, a stickler created by the reduced width of the quarter-track.

(Continued to page 218)



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In any recording there is some undesirable noise. The trick is to make the program signal so strong that a gap is created between music and noise levels. This permits you to drop out the noise without losing part of the music. The lower the signal-to-noise ratio, the harder this is to do. And signal-to-noise ratio is inherently lower with smaller track width.

For $7\frac{1}{2}$ i.p.s. operation, this track-width problem is licked by special head design. But even this can't completely eliminate the problem at $3\frac{3}{4}$ i.p.s. The slower speed also creates special distortion difficulties where extreme high frequencies are involved.

All in all, tape recorded at $3\frac{3}{4}$ i.p.s. at the present state of the art suffers enough from distortion and from limited frequency and volume range to make it a second runner to stereo discs in the quality sweepstakes. Since discs have problems of their own, including their classic snaps, crackles and pops, $7\frac{1}{2}$ i.p.s. tape remains the quality king of them all.

Most experts see the cartridge as strictly a mass-market product, not really suited to the true high-fidelity market. Could be. But a stereo cartridge recorder costs about \$299.50. Compare that with the price of a package stereo phonograph. Besides, for about the same price you can


get a good reel-to-reel tape recorder, one that gives you a choice of either top audio quality or cartridge quality with twice the playing time for the tape dollar.

Even the cheapest cartridge player costs over \$100. Since such a player must be used with an external preamp-amplifier combination, its price has to be compared with that of a stereo record changer. That means you pay \$30 to \$40 more for the privilege of using tape cartridges instead of the better sounding discs.

When all is said and done—barring startling new developments—it's probably a safe bet that cartridges will never seriously challenge stereo discs for the mass music-lovers market. It's an equally safe bet that the new quarter-track, reel-to-reel recorders are going to make a lot of new friends for stereo tape. ★ ★ ★

Answers to TOOL IQ, Page 183

- 1.—Double Caliper.
- 2.—Fence Builder's Adze.
- 3.—Bit Stock.
- 4.—Coachmaker's Saw.
- 5.—Cooper's Howel.
- 6.—Gouge.




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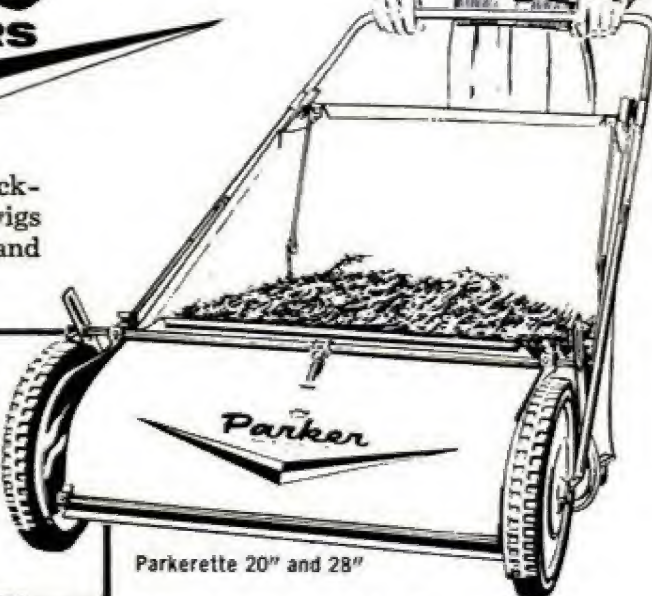
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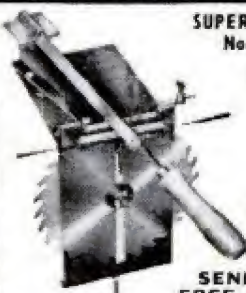
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We're Listening for Other Worlds

(Continued from page 85)

electrical discharge (lightning), a reproducing molecule was changed into a reproducing cell. And from this humble beginning evolved 10 million species, including man, who now is able to speculate the odds that a similar process occurred elsewhere in the universe.

According to this view, the same process not only is possible, but inevitable, on other planets with similar environments.

"Life is probably the inevitable consequence of chemical evolution wherever physics, chemistry and climatology are right," says Harlow Shapley.

Such conditions can be right only on certain planets. The planet must circle at least a second-generation star (to provide the heavier elements necessary to life). It must have water. It must have a steady temperature over a long period of time to permit a molecule to evolve into a brain. The temperature must not only be steady, but within a narrow range.

(The Earth's extreme annual variation in temperature is about 250 degrees F. The hottest temperature ever recorded is 136 degrees, and the coldest minus 124. At any given point on the land area of the Earth, though, the difference between the highest and lowest temperatures of the year averages about 100 degrees).

Spores Might Spread Life

Can life spread through the universe, without originating on each suitable planet? Research proves that spores can live for long periods in an environment similar to space. Melvin Calvin of the University of California has studied meteorites and found no evidence of life. But he has found large organic molecules similar to those that may well have evolved into life on Earth.

A more fascinating theory is expressed by Prof. Thomas Gold, director of the Cornell University Center for Radiophysics and Space Research. He feels that life may well be hitchhiking from planet to planet. Perhaps in 50 or 100 years, he points out, we may be able to visit planets of other suns. On those distant worlds we will inevitably leave behind viruses which, in a suitable environment, may evolve someday into intelligent life. Perhaps in a billion years the descendants of "our" viruses will be intelligent creatures able to spread life to still other planets. The startling implication of this "contamination" theory is that we are descended from viruses left behind by space travelers of the past!

Both the "contamination" theory and the "inevitability" theory presuppose a planet with a suitable environment. What evidence do we have that there are such planets—in effect, twins of the Earth?

Most of the evidence involves mathematical probability. Of our own galaxy's 100 billion stars, for example, astronomers say that 10 percent are twins of our sun, essentially identical in size, luminosity and chemistry.

They also rotate slowly. Dr. Otto Struve, Director of the National Radio Astronomy Observatory (and Drake's boss), originated the now-accepted theory that a slowly rotating star is strong evidence that the star has a covey of planets. According to the theory, the planets sap much of the star's original rotational energy.

If you assume that each "twin" of our sun has only five planets (our sun has nine) you come up with a figure of 50 billion planets in our galaxy alone.

How Many Suitable Planets?

Now carry this numbers game a little further. How many of these planets are the "right" distance from their suns, and are able to support life? Dr. Harold Urey of the University of California estimates that life exists on at least 100,000 of these planets. Other scientists consider this a conservative figure, and their estimates range up to a million planets upon which life exists *right now*.

Drake states that within 100 light-years of our sun (our "near neighborhood" by astronomical standards), it is highly probable there is intelligent life. "Within the galaxy, it's virtually certain," he says.

Stars have various ages. Therefore, various levels of life must exist on their planets. Thus we can expect degrees of intelligence both superior and inferior to our own.

It is from the superior beings that Dr. Drake expects his signal. Such creatures, according to P. Morrison and G. Cocconi of Cornell (who have done much of the preliminary study in this field), must look upon our Sun as a likely candidate for a scientific community. They are anticipating some signal from us. Indeed, they may already be aware of our presence.

"Certainly," says Dr. Struve, "at the present time man-made production of powerful beams of radio-radiations has produced a change in the physical properties of the Earth that could be detected from a distance of 10 or 20 light-years."

Such beings, say Morrison and Cocconi, will already have set up a channel of com-

(Continued to page 222)

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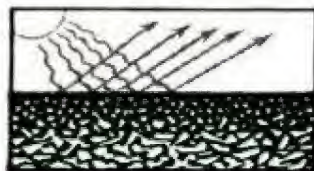
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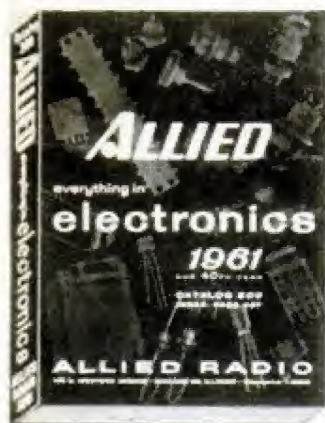
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munication. The only known way to transmit a signal through space is by electromagnetic radiation. The complete spectrum of such radiation covers everything from very short cosmic rays through visible light to very long radio waves. Only radio waves, so far as we know, can be "manmade" and transmitted for great distances. Thus we should start listening for a radio signal from our intelligent other-world neighbors.

At what wavelength? Ask any astronomer or physicist to specify a "universal" wavelength and he will immediately suggest 1420 megacycles. This is the radio-emission line of hydrogen—the "parent" element of the universe.

Scientists have developed a relatively new and extremely sensitive instrument for "listening" to radio signals. It is the radiotelescope, which can focus on the radiation emitted by stars and clouds of interstellar dust.

Radiotelescopes Unbelievably Sensitive

The sensitivity of the radiotelescope is difficult to believe. Here's an example cited by Dr. Drake: To us, the strongest radio source in the heavens, with the exception of our own Sun, is a star called Cassiopeia A. This "strong" star sends the total surface of the Earth about 50 watts of radiation—just enough to light a standard bulb. The amount of this energy falling on the dish of a radiotelescope is infinitesimal, yet the scope can focus on the power source and come up with a meaningful analysis of the radiation.

Indeed so sensitive are today's radiotelescopes that they can record what actually occurred 10 billion years ago.

In your imagination, transport one of our existing radar transmitters 100 light-years out into space. Now turn the radar until its signal is beamed toward your old home planet. A hundred years later the signal will be detected by a 600-foot radiotelescope, similar to the one the Navy now is building at Sugar Grove, W. Va.

Within 100 light-years of Earth are more than 10,000 stars, and at least 10 percent of them are twins of our Sun. The odds are high that some of these planets support rational beings. Still playing the odds, half of these civilizations are more advanced than our own. Our most powerful transmitter on Earth today is about one megawatt. Therefore we can assume that half the other-world beings will have a transmitter at least this powerful. All they have to do is ring us up on the radiotelescope.

The 85-foot scope which Dr. Drake is using at Green Bank can detect signals

(Continued to page 224)



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Treatment Plant on Truck Converts Helium Into Liquid

Mounted on a truck, the U.S. Navy's new helium liquefier rolls around Lakehurst Naval Air Station, N.J., where the helium is used in a variety of experiments. The mobile liquefier can convert 45,000 standard cubic feet of helium into its liquid state each day. The liquid has a temperature of -452 degrees F. Among other things it is

used as a pressuring and purging agent in many liquid-fueled missiles because it does not combine with other elements. Since there are increasingly more uses for the super-cold liquid, the Navy is studying the economics of transporting helium in this state. The liquefier is the prototype of a larger unit which may be built.

from a one-megawatt transmitter up to about 30 light-years away. Within this close neighborhood are two stars that seem likely candidates. They are Tau Ceti and Epsilon Eridani.

In April, Dr. Drake began pointing the 85-foot scope alternately at these stars. Specifically what he looked for was a pattern of bumps on a pen-traced graph. If a signal is received, there's not the slightest doubt that it will be recognized. All other cosmic noise is random, formless, without pattern.

No elaborate schedule has been laid out. When the project began, Dr. Drake tried to pick up a signal for six hours a day for a month or so. Then the scope was put to other use, but will be aimed at the two stars again later. Drake is convinced that the search will go on, by fits and starts, at Green Bank or elsewhere, until a signal is picked up.

Other scopes may join the search. The 600-foot Navy receiver, for example, could pick up one-megawatt messages from at least 60 light-years away, and the 1000-foot bowl planned for the Puerto Rican hills could hear a message across more than 100 light-years. Within this region there are about 10,000 stars.

What will happen when an intelligible signal is detected? What a field day for

headline writers—the greatest news story of all time. It's a safe guess that the highest government officials and scientists will meet in hasty conferences to decide what to do.

Should We Answer?

The question has even been raised: Should we answer at all? Cal Tech's Albert Hibbs has said that the risks of reply are "just terrible." In the eyes of such out-of-this-world creatures, he points out, "we may be the finest beef animals ever."

But Dr. Drake feels that we can't help but answer. "In any case, remaining silent will not protect us," he says. "We already radiate signals sufficiently strong to be detected by another intelligent community. If we wanted to remain hidden, it's too late now—already we have broadcast our presence."

The most powerful transmitter on Earth, very likely, will be focused on the invisible citizens of the distant world. A two-way conversation will start. It won't be neighborly gossip, though. Any question we ask of a citizen of Tau Ceti will take 11 years to reach his ears (if he has any ears!) and another 11 years for the reply to arrive.

According to Dr. Drake, the language barrier won't be insurmountable. "What

(Continued to page 226)



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Most comfortable ever! Weigh a pound less than ordinary work shoes. Their exceptional lightness is so easy on the feet. Uppers are flexible elk-tanned leather . . . soles are springy, oil-resistant, neoprene cushion crepe, nearly three-quarters of an inch thick. Steel shanks, of course. And smart sports styling plus handsome Burgundy color add good looks to the comfort.

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Nature-Made Radio Pipeline May Spur Intercontinental TV

Intercontinental television could become a reality with discovery of a nature-made pipeline. An experimental program by the United States Navy and Air Force shows that there is a sort of radio pipeline about 5000 feet above the South Atlantic Ocean. About 500 feet thick, it is described as an atmosphere duct capable of trapping and transmitting radio waves at a low loss. The Air Force research center said it might be possible to send radio voice or television-type signals from England or Europe to Spain and from there to French West Africa for transoceanic transmission. The United States would be linked by oceanic duct with Puerto Rico.

Vinyl-Based Solid Rocket Fuel

Fire-resistant vinyl plastic is now being used in a compound to provide a solid fuel for rockets. In the propellant, polyvinyl chloride reacts with ammonium perchlorate with a powerful release of energy. At present, the manufacturer is casting the solid fuel propellant, using molds to shape the mix to the design required for a particular rocket.

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we need," he says, "is a cosmic Rosetta Stone—something that, so far as we know, would be universal, and could be decoded by a scientific mind anywhere. It could be a sequence of prime numbers, or a coded version of the periodic table of elements, or the laws of physics. Once such a message is interpreted, a common language could be built upon this base."

Eventually he feels the best transmission would be television pictures. The transmission would be quickly recognized as a pattern, and analyzed. It would be simple today for Earth scientists to solve such a pattern and build a receiver suitable to convert the signal into a picture. Presumably the advanced minds at the other end of our messages could do the same.

Dr. Drake sees tremendous advantages in such an "interview." Have these other-world beings harnessed fusion energy? Do they have cancer? How have they solved their own social problems?

Perched on his mountaintop, Dr. Drake is seeking a "hello" from a kindred mind in outer space. The work may go on spasmodically for generations.

But even in his secluded laboratory, Dr. Drake cannot escape the problems of his own world. As you enter his office, you notice a small sign on the door.

It asks: "Is there intelligent life on Earth?" ★ ★ ★

Do You Know This Old-Timer?

(Answer to quiz, page 18)



1904 Darracq
(FRENCH)

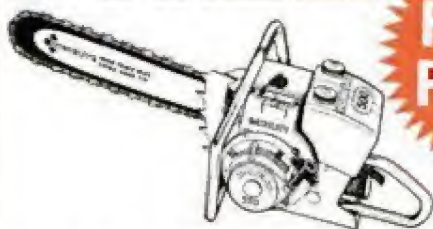
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Here's all you do to obtain your free copy of the "Shoot the Works" contest rules and entry blank — stop in at your nearby Homelite dealer's or write to: Homelite, "Shoot the

Works Contest," Port Chester, N. Y. Then, fill in the entry blank, stamp and drop it in the mail.

That's all there is to it! Nothing to buy, no obligation. Don't wait, get your entry blank today. You'll find your Homelite dealer in the Yellow Pages under "Chain Saws."

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Under-Window "Defroster"

(Continued from page 157)

as neatly as you can, avoiding studs by checking beforehand. The hardboard collar will cover any raggedness of the hole. You can spot the approximate location of the opening in the outside wall by drilling a pilot hole through from the inside. A key-hole saw is used to cut through the siding and sheathing. Before installing the defroster in the wall it is a good idea to paint the pipe with asphalt paint. Then smear some spackling compound on the back side of the hardboard collar and press it in place against the wall. An aluminum collar is pressed over the end of the pipe on the outside wall and caulked. A choice of patterns is given for the hood which is cut from sheet aluminum and riveted together as shown. The top edge of the hood is forced up under the siding, centering it over the inlet pipe and then nailed to the siding with four aluminum nails. ★ ★ ★

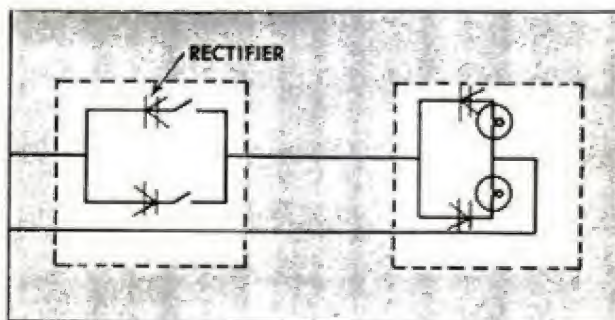
QUOTE:

"In science, particularly, the tendency more and more has been to penetrate farther and farther into chosen subjects until specialists dig themselves deep out of sight, out of hearing, out of understanding of what other scientists are doing in their own and neighboring fields. And, if this state of affairs is alarming, even more alarming is the growing cleavage between science and scientists as a whole and the great mass of humanity in other callings."

—T. KEITH GLENNAN
Administrator, NASA

Answer to Electric-Circuit Puzzler

(Page 186)



How is it done? It's simple. The single 110-volt circuit actually is converted to three separate circuits by employing four selenium rectifiers, one in series with each bulb and one in series with each switch, as shown in the diagram above. The seven-watt pilot bulbs allow the use of small rectifiers.

An Idea for Taillights

Dr. Howard D. Garber of Los Angeles, an optometrist, proposes something new in taillights to avoid rear-end and chain auto collisions.

"The vastly increased area of auto windshields enables one to view one car through another, several cars ahead, depending on road conditions. If the taillights of all cars were at higher positions (as illustrated)



one could observe not only the tail signal lights of the car immediately ahead, but signal lights further ahead, particularly at night. This would reduce our dependency on the reaction time of the driver immediately ahead in applying his brakes, since warning of halting traffic would come from taillights visible further ahead."

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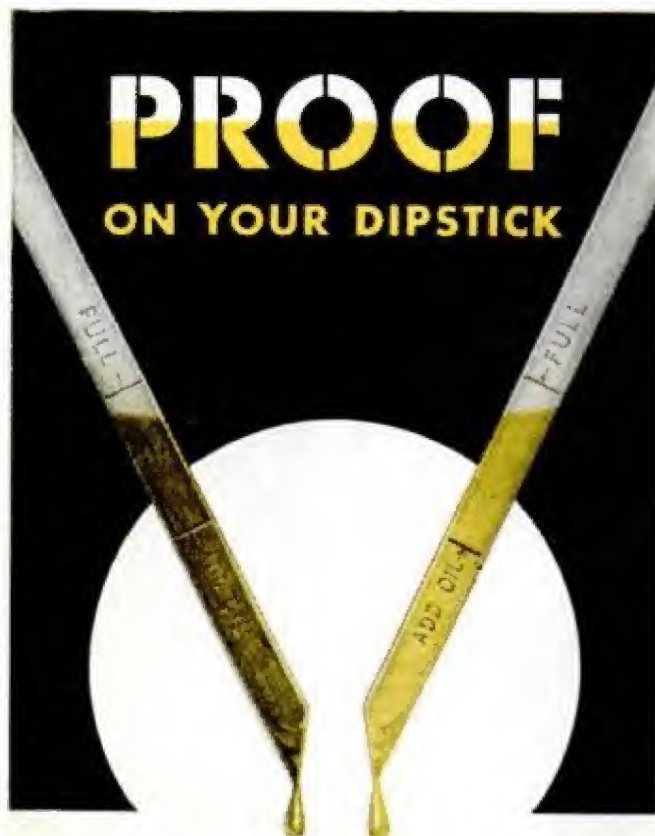
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This Business of Spying

(Continued from page 100)

the information as to its probability and reliability of the source and flashed it back to General Kuznetsov in Moscow through embassy communications channels. Kuznetsov checked the report against other sources, which confirmed the startling fact of the bomb. He once again graded the information and then brought it to the man who needed it, Joseph Stalin.

The inordinately suspicious mind of Stalin often caused him to doubt well-authenticated intelligence reports, but in this case he took the information at face value and directed that an all-out effort be made to steal the secret. How Red spy nets in the English-speaking nations went to work made intelligence history. Within three months they learned all the needed scientific details, even down to the trigger mechanism and blue prints. Our vaunted security measures proved tragically ineffective. We would never even have learned for sure that the Reds had stolen our secret except that years later, Igor Gouzenko, a cipher clerk at the Ottawa embassy, deserted to our side and told all he knew. Even then we were only able to capture part of the atomic spy ring. The rest are probably still at work systematically gaining information, appraising it and passing it back to Moscow.

Since the early 1930's the accomplishments of Russian spies have been so outstanding that they have earned the begrudging admiration of intelligence students in the free world as well. That the Reds time and again have been able to knife into the free world's inner sanctums is no accident. It is a triumph of careful organization and painstaking preparation. Even under the Czars the Russians, with an annual budget of approximately \$5 million were noted for their concentration on intelligence. Now with a yearly budget estimated as high as \$500 million Russian intelligence is probably the best-heeled, best-muscled and best-nerved shadow army in the world. The Russians are also fortunate in being able to manipulate the minds and loyalties of millions of native Communists in the free world to obtain the services of dedicated amateurs when the occasion demands.

Whether we are talking about the Red intelligence organization, our CIA, the Secret Intelligence Service of the British, the resurgent intelligence of West Germany, or that of France, Japan, Cuba or any other major or minor power, there are certain things that they all must do.

To begin with there is the matter of selecting potential agents. It takes a peculiar breed of a man to be a spy. As a CIA recruiter put it to an old OSS friend of mine, "Have you met any well-adjusted psychotics lately?" Normal people like to be open about their actions and words. A spy cannot afford to be. He cannot, on the other hand, be deranged or odd, or he will soon betray himself, or at least be incapable of accurately gathering and rating information. He must be capable of withstanding intense loneliness and the unnerving threat of hidden dangers.

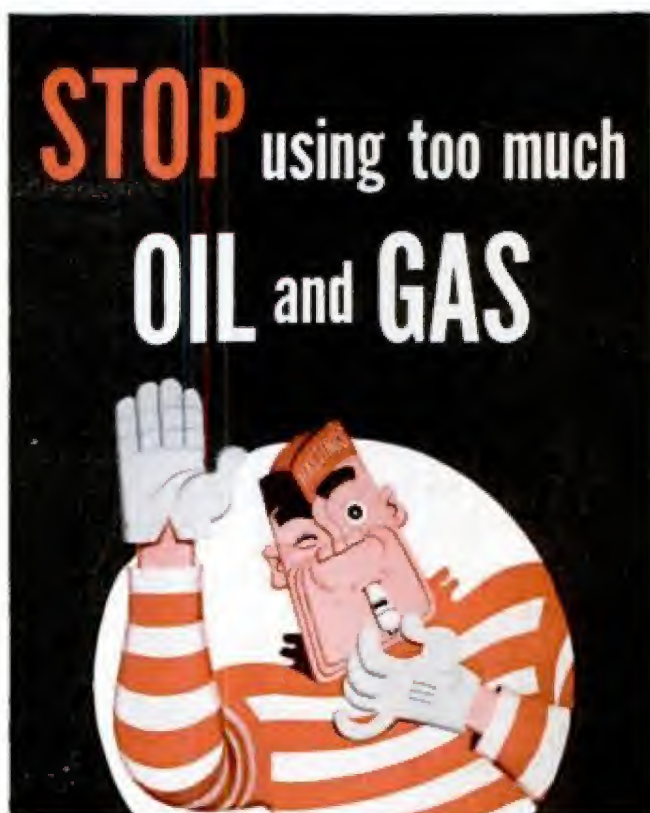
A spy must remain cool in a crisis as did a World War II OSS agent who was returning to Bordeaux from Paris. Carrying his suitcase which contained a telltale radio transmitter, he went to the railroad station and found the platform deserted. Prayerfully he got onto a train and took a seat in a compartment. In a moment there was a heel-clicking flourish of protocol and Field Marshall Rommel appeared. Followed by his adjutant, Rommel entered the astounded agent's compartment and sat down. The agent was apologetic. He did not wish to intrude. He was bound for Bordeaux and had climbed aboard the wrong train. He begged the Field Marshal's permission to leave.

"Not at all," replied Rommel graciously. True, the train was for German staff officers, but the army owed it to civilians to share accommodations where possible. He leaned forward and confided that he was making a tour of southern defenses and lengthily discussed his views on Allied bombings. Then, his aide at his heels, he left for another compartment. Soon the adjutant came back. The agent quailed inwardly.

"The Field Marshal would like to know if you would care to join him for tea," the adjutant said. The OSS man calmly sipped his tea with Rommel. When the train reached Bordeaux, he hefted his suitcase and went off on his mission.

As might be expected the coolest agents of all are British. One night a British spy in neutral Sweden bribed the guard and entered the office of the German embassy air attache in Stockholm. He set right to work in a businesslike way copying top secret documents. Then the door opened and to his shock, a Luftwaffe captain walked in. The agent fought down an impulse to plunge through the window and flee. He went right on copying. He sighed wearily over the long hours a man must work. The captain gave him a bored look,

(Continued to page 232)



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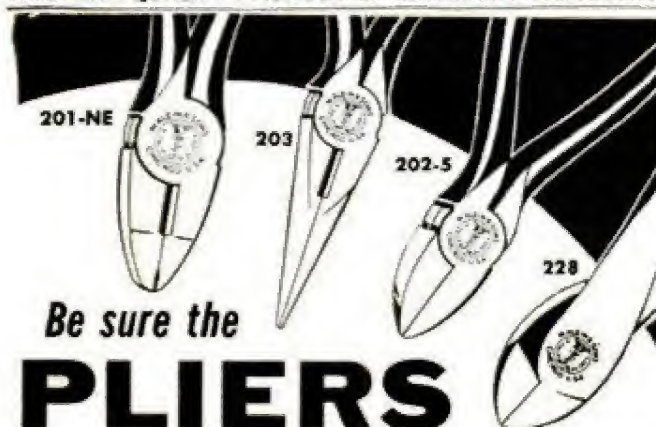
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went to a wall safe, took out a bottle of Scotch, and left.

A valuable spy might look and act like a congenial businessman intent on nothing more consequential than a deal, but he must be an egghead with courage and determination. Contrary to popular notions, he draws relatively little pay and therefore whether he is a CIA agent or a Red spy he must be motivated above all by his cause or patriotism. No particular profession helps a man qualify as a spy. Lawyers or doctors, for example, may be accustomed to keeping professional secrets, but they do not necessarily make good agents. Journalists are very good at gathering information, but we have the unfortunate instinct to tell everything we know to as many people as we can.

Just how miscellaneous a group a spy net may be was demonstrated when Hitler took over Austria. With the bloodless conquest, an assistant foreman in a print shop emerged from cover as number one Nazi spy. When he called together his apparatus at the chancellery, his 1000 agents were found to include policemen, mailmen, bank clerks, telephone repairmen, businessmen, teachers and government officials. Most were Austrians who favored the Nazi cause.

Some of the most surprising people have been agents. Jumping Joe Savoldi, Detroit Tigers pitcher Tommy Bridges, movie actor Douglas Fairbanks, Jr., explorer and lecturer Nicol Smith and the expatriate White Russian, Prince Serge Obolensky, all served in OSS. Novelist Somerset Maugham was in British intelligence. There is a pretty young matron in the suburbs of a large American city who was once the most dangerous OSS agent in the Middle East. Now she contents herself with innocent intrigues in the local PTA.

Agents must undergo exhaustive testing and training. In OSS we were particularly proud of our psychological testing of agents, and I understand CIA is equally proud of its methods. But it was the Germans who pioneered in this field. They had an impressive testing program as early as World War I. Elsbeth Schragmuller was a German schoolmarm, but her school was not devoted to the three R's. She taught black intelligence and also sabotage which frequently is a spy's sideline.

When a neophyte was brought to her, she locked him in a well-furnished room upstairs. He had a desk he could use for writing, books to read, a comfortable bed, all the amenities of home. But for days on end no one interrupted his loneliness ex-

(Continued to page 248)

POPULAR MECHANICS

Scientists Study Kelp Shortage

Scientists at the Scripps Institute of Oceanography are working to solve the "mystery of the disappearing kelp." The valuable sea algae has declined 75 percent in the water off Southern California in the past few years, and a two-million-dollar industry is threatened. Dr. Wheeler North, biologist in charge of the kelp studies at the Institute, reports that several factors are contributing to its decline. Unseasonably warm coastal waters have caused much kelp to die; it begins to disintegrate when the temperature reaches 65 degrees, and at 70 it dies. Locustlike hordes of sea urchins

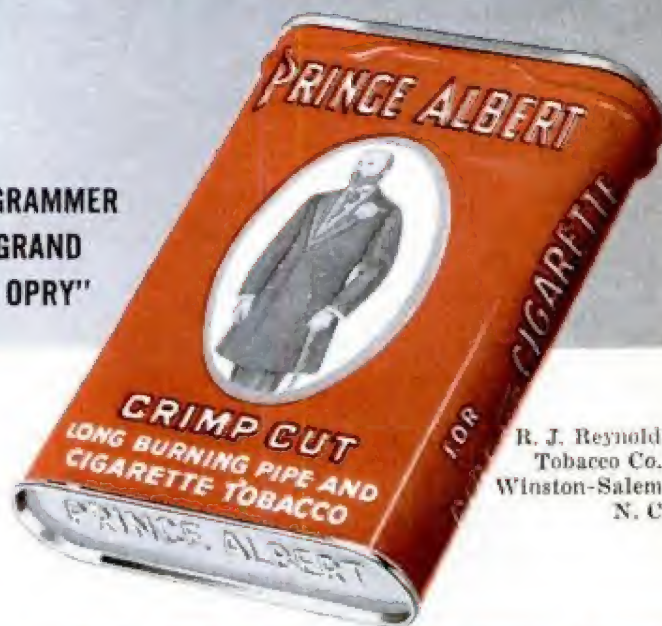
are eating whole kelp beds, and scallops are killing even more than the urchins. The scallop larvae attach themselves to the kelp fronds while they are very small, but as they grow bigger, their weight forces the fronds to the bottom, and the plant dies for lack of sunlight. Other factors found in the study were storms, dirty water, and black rot disease. The industry most threatened by the shortage of kelp is the manufacture of industrial chemicals, particularly that of algin, a chemical with many uses in food processing, sizing and dyeing fabrics, and as a thickener for plastics.



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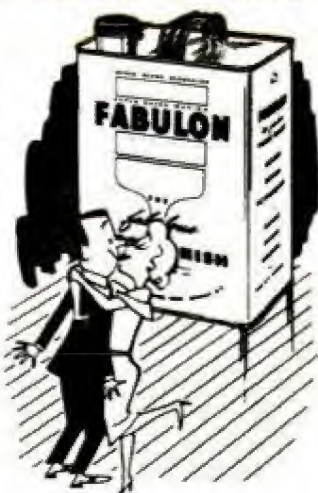
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Here's a sturdy work oxford, with all the styling, fit and comfort of a dress oxford! Shaw's high value features include full cushion in-sole heel to toe with metatarsal pad and cushion side arch support ... oil resistant Neoprene sole ... steel arch ... Nylon stitched ... plus the finest leathers and craftsmanship, in black or Cordovan color. AT STORES EVERYWHERE, or write us for details.



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Today's
top values,
\$10.95 to \$14.95

M. T. SHAW, INC.
Coldwater, Michigan

"37 Years of Quality Shoemaking"



Rehearse for the Hunt

(Continued from page 144)

the opposite. It teaches him to make positive identification at long distances (the silhouettes are placed at varied ranges from 100 to 300 yards away), and also aids him in learning to judge distances accurately. This is all-important, especially in Western states where the targets are likely to be way out yonder.

We've got other games to sharpen our shooting eyes and reflexes, like firing at balloons bouncing erratically across the ground in a brisk breeze (always in front of some backstop to block ricocheting bullets), or firing at an old casing with a cardboard insert bouncing down a hillside (this is a fine system for learning to lead moving targets correctly), or shooting at a target swinging by a rope from the limb of a tree.

Skeet Range Good Practice

If you are a bird-shooting enthusiast, some first-rate practice is only as far as the nearest trap and skeet range. A so-called "round" of either is 25 targets. A trap layout has five different shooting positions adjacent to one another in a crescent-shaped formation: the shooter moves to the right one position every time he completes five shots. The trap is hidden in a low concrete building in front of the shooter and targets are tossed out at varied angles unknown to the shooter.

A skeet field is laid out in a half circle. There are eight shooting positions, with two single targets being shot from all eight positions and "doubles" from four positions. There are two target houses—a "high house" where targets are thrown high, and the "low house." All targets are thrown in the same pattern of flight, but the angle of the shot is different as the shooter changes positions. The twenty-fifth shot is optional since it is a repeat of the first miss, or optional from any position if the shooter has broken twenty-four consecutive targets.

In many towns, however, there are no trap or skeet facilities. Two people can accomplish the same objective with a hand trap and a supply of targets, or clay pigeons. Hand traps are available at most sporting goods stores. There are two types—one throws only a single target; the other either a single or double.

Get in an open area where there is plenty of elbow room for shooting and take turns, one person shooting while the other throws the targets. With some practice the thrower can learn to simulate practically any upland bird situation, from low hedge-hop-

(Continued to page 236)

Everything for the Craftsman!



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AND HOME WORKSHOP CATALOG

Finest Domestic and Imported Woods
... Mouldings, Hardware, Tools ...
ALL AT LOW MONEY-SAVING PRICES!

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See them next month in

POPULAR MECHANICS

SEPTEMBER 1960



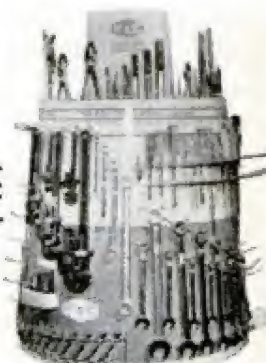
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You'll find P & C screwdrivers on the colorful P & C Merchandiser in your favorite hardware store.



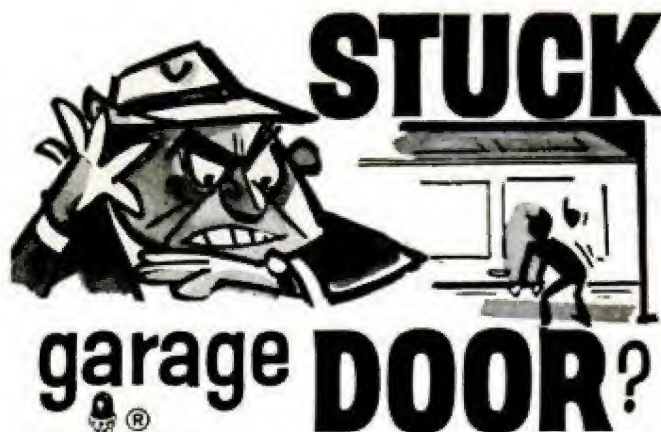
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WRITE FOR
LITERATURE

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The famous Turner Torch... for soldering, light brazing, thawing frozen pipes, burning weeds, removing paint, laying tile and hundreds of uses... now on sale with the green tank that contains 10% more fuel than any other disposable tank.

SAVE \$1.00. Buy the regular Turner Torch now with two tanks for only **\$7.89** complete

Available wherever hardware is sold or write

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ping birds to those which climb almost straight up, with the simple hand trap. This practice is particularly helpful since it teaches the shooter to swing smoothly, and the secret of scoring consistently in bird hunting is a properly grooved swing.

Another, perhaps even better type of practice for any kind of shooter is varmint hunting, which can usually be done at any time of the year. Crows, woodchucks, coyotes, or any other undesirable wildlife can make fine early-season sport and will serve the conservation effort as well. But check first with your state's game laws to learn what, where, and when to shoot. A varmint in one state can be a protected species across the border in a neighboring state.

Look over the accompanying illustrations and learn how you can enjoy practicing for the upcoming hunting seasons. Everything is there except real live game—and perhaps this tune-up even will help you bring *that* home later this year. ★ ★ ★

Studies by the National Aeronautics and Space Administration of the orbital flight of the Vanguard I satellite have shown that sea level in the north polar region is 50 feet higher—and in the south polar region is 50 feet lower—than had been thought.

This Month's "Great Pioneer in Science"

(Page 22)



George Westinghouse (1846-1914)

"GLEN L" BOAT PLANS PATTERNS & FRAME KITS

LARGE SCALE BOAT PLANS, FRAME KITS AND FULL-SIZE PATTERNS SPECIALLY PREPARED FOR AMATEUR BUILDERS

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NEW WORKSHOP IDEAS!

Every issue of THE DELTAGRAM—popular bi-monthly home workshop magazine—brings you 28 colorful pages packed with ideas. Projects for extra fun and profit are fully illustrated, include plans, "how to" instructions, and bills of materials. Get 1 year subscription for \$1.75 (or 3 years for only \$4.00!) Send check or money order to: THE DELTAGRAM, Rockwell Manufacturing Co., 502J N. Lexington Ave., Pittsburgh 8, Pa.

(Item 24)



World's THRIFTIEST Light Plants

700 Watt, push button start, 115 v. 60 cyc. AC. 2.2 HP, easy starting Briggs eng. No wiring necessary: just plug in and operate. Plenty of current for any oil burner, freezer, brooder, emergency lights, etc. which require up to 700 watts. Ideal for television and radios. Complete with voltmeter and built-in winding to charge auto batteries. (Item 24) Wt. 75 lbs. Easily fits in our trunk. Be prepared if storm knocks out power lines. Reg. \$275... **\$143.50**

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for lasting Home Repairs

PERMANENTLY mends cracks or holes in wood, tile, stone or plaster. Sticks and stays put—Does not chip, shrink or fall out. Easy to use. Economical. Mold it, chisel it, polish or paint it. The big 4-lb. can is obtainable from your lumber, paint or hardware dealer at \$1.40; or will be shipped direct postpaid (in U. S.) for \$1.75. Complete satisfaction guaranteed or your money refunded.

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This may be the lowest cost full-sized chest in America! 4 sliding drawers in blue-gray rugged steel cabinet. 26" x 12 1/2" x 12 1/2". Keep your valuable tools safe, clean and always at your fingertips.

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A glass packed muffler that looks like original equipment—of popular flat oval shape—with a tone that's mellow without bellow—distinctive, but lullaby-low!

NEW SHAPE—Redesigned with compact flat oval, just 3 in. thick. Fits all cars snugly, with more road clearance.

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... plus these advantages!

- Two types of fiber glass for best tone
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- Takes little time and work to install
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And be sure to see the famous Goerlich—original equipment type mufflers—the economical Standard or deluxe Master. Either is the biggest buy for your dollars.

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MUFFLERS AND PIPES

Dept. 2J, 619 Smith St., Toledo 1, Ohio

Magnetic Quenching Forms "Supermetals"

Conventional steel and titanium alloys are being turned into "supermetals"—with strengths in some cases more than 100,000 pounds per square inch above normal—by a new process that borrows from an old and well-known physics experiment. In the experiment, iron filings are scattered at random on a piece of paper; a magnet placed under the paper causes the filings to become uniformly arranged.

"Our process resembles standard heat-treating procedure," says William I. Basset III, who developed the process for Research Development Corporation of America, Gardena, Calif. "However, we use an electromagnetic field to improve the basic nuclear structures of metals. It's a well-known fact that many fabricated metals can be strengthened if they are properly heated, then quenched. But it hasn't been practical to bring out the greatest possible strength in most alloys, since the heat required would cause them to become excessively brittle."

Heat alone created a chaotic condition in the metals. Consequently when they were suddenly quenched in some medium such as water or oil, their nuclear components were frozen in odd patterns which produced many weak spots in their structure.

"We move hot metals from a furnace into a strong magnetic field," Basset says. "Due to the semifluid condition of the materials, the field is able to orient, or align, their nuclear constituents—much in the same manner as in the experiment with iron filings. Because the metals remain in the field until they are cool and stabilized, the uniform alignment is retained and the metals have high strength as well as excellent ductility."

Basset says high-strength steel parts treated by the process can be bent 180 degrees without breaking. In addition, the parts have none of the warpage or variation in dimension that is sometimes found in conventionally heat-treated parts and their ability to resist corrosion is improved.

QUOTE:

"The solution of almost every problem we have in maintaining our leadership in science and engineering must begin with better education. Particularly is it important at this juncture to strengthen and extend graduate education."

—JAMES R. KILLIAN, JR.,
Chairman of the Board,
Mass. Inst. of Technology

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make from \$3 to \$6 an hour
with the FOLEY SAW FILER

Ask yourself these three questions: 1. Do I really want to get ahead *faster*? 2. How can I do it? 3. Am I willing to *use* my spare time? If you answer "Yes" to questions 1 and 3—then we have a positive answer for you on No. 2. Men make from \$3 to \$6 an hour sharpening hand, band and circular saws with Foley Saw Filers. No experience needed, to turn out sharp, smooth-cutting saws with this automatic machine. Start in spare time—no canvassing.

HERE'S THE WAY TO START

Read "Money Making Facts"—shows you how others have added hundreds or thousands of dollars to their incomes in this steady, repeat, CASH business. Start your *own* business in your basement or garage, no overhead, small investment. With *Time Payment Plan* the Foley can more than pay for itself out of profits. Send for "Money Making Facts"—mail coupon now. No salesman will call.

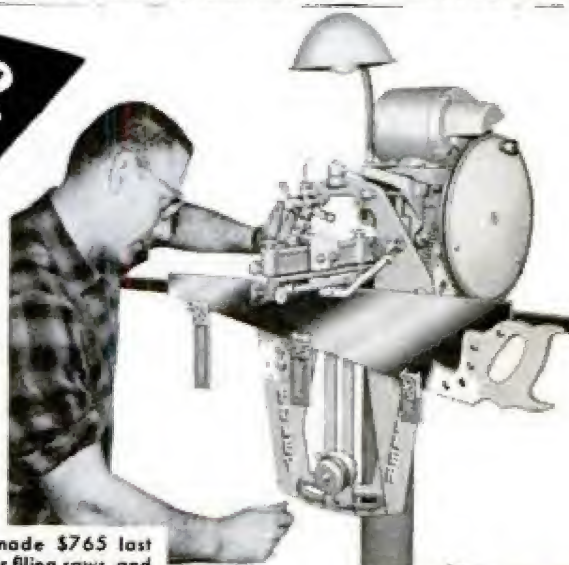
HERE'S PROOF

"When Mr. Patrick got his Foley Saw Filer in March 1946 he made a good and wonderful investment. He has done so well that we bought a house and paid for it; bought a new car, built an addition to our house. Nicest of all, it's all paid for." Mrs. Leslie Patrick.

"I made \$765 last year filing saws, and it sure comes in handy. I do this work in my spare time." —James B. Williams

"Last year's profit amounted to \$3,000. Not so bad for a one-man outfit." —Charles C. Hough.

"I have done 4 or 5 thousand saws in my spare time in the 4½ years since I got the outfit, and they are all coming back with repeat orders." —Len Crego.



FOLEY MFG. CO., 916-0 Foley Bldg., Minneapolis 18, Minn.

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It's easy: use Formica Safe-Bond, the new non-toxic, non-flammable adhesive that "tells" you when to contact. And surprise "the missus" with Formica laminates in the smart new Raymond Loewy designs. Get Formica Safe-Bond and sheet stock at your local lumber dealer. Formica Corp. Cincinnati, Ohio.



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SOLDER **CUT**



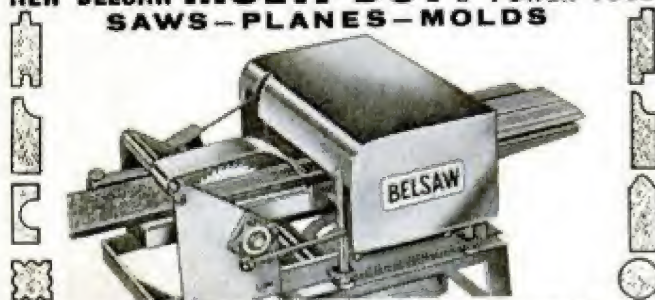
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WELDER
Complete with
Twin Carbon Arc
Torch and ac-
cessories... to
handle all metal-
craft work.

NEW BELSAW MULTI-DUTY POWER TOOL SAWS—PLANES—MOLDS



Now you can use this ONE power-feed shop to turn rough lumber into moldings, trim, flooring, furniture... ALL popular patterns. RIP... PLANE... MOLD... separately or all at once with a one HP motor. Use 3 to 5 HP for high speed output. Low Cost... You can own this power tool for only \$30.00 down payment.

Send postcard today for complete facts.

BELSAW POWER TOOLS, 901 Field Bldg., Kansas City 11, Missouri

An Eye on Space

(Continued from page 88)

six months later he sights again—and he has his two angles! And the base line is 2×93 million miles, or 186,000,000 miles.

Measuring by this method, the nearest star comes out to be about 24 trillion miles away (24 followed by 12 zeros). Incidentally, when light travels for one full year—at 186,000 miles per second—it covers a distance of about 6 trillion miles. So we can say that the nearest star is about four "light-years" away.

But even this method with our orbital baseline is good only up to distances of about 100 light-years. Again, we begin to get angles of nearly 90 degrees for larger distances, and again our triangle becomes unreliable.

So what to do?

There is a way of beating the rap again. Next month we'll discuss the problem of measuring the really BIG distances. Do you know what the greatest distance measured is? A couple of colliding galaxies have been spotted at a distance of 6 billion light-years. That is, a distance of 6,000,000,000 x 6,000,000,000,000 miles; or at a distance of 36,000,000,000,000,000,000 miles.

Anyone for a tape?

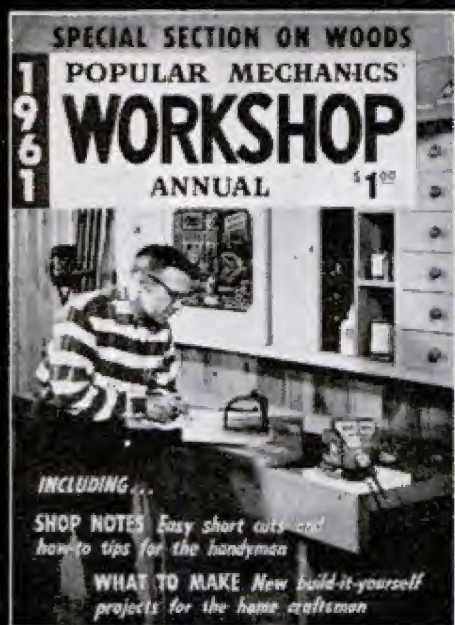
★★★



Ultra-High-Speed Russian Camera

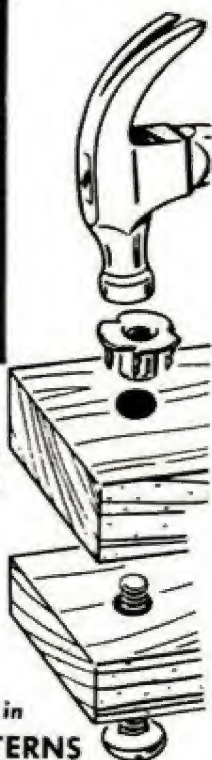
Reportedly 1000 times faster than an ordinary electronic flash, Russians claim a new camera can take 2.5 million pictures a second. The lens focuses on a rotating mirror that reflects the image onto a semi-circular strip of film. Metal gratings break down the streak into separate pictures.

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BIG WHAT TO MAKE AND SHOP NOTES SECTIONS
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Use this flush mounted, "can't slip" nut that needs no washer!
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 fastener!



Now specified in
EASI-BILD PATTERNS

Get them both at Hardware, Variety
 and Lumber Stores:

Ask for TEENUTS!

COLUMBIA FASTENER COMPANY
 Chicago 8, Illinois



Owners Report on the Thunderbird

(Continued from page 106)

Most of these complaints on cooling failure come from owners of air-conditioned cars. →

"Doors too heavy, thus require effort when getting out of car."—California accountant.

"Reverse angle of windshield increases difficulty in getting in and out of the front seat."—Indiana doctor.

"I'm getting tired of difficulty getting in and out of car in close quarters at parking lots."—

"Hole in top of piston at 12,000 miles."—Missouri TV director.

"The cooling system is wholly inadequate, car overheats easily, carburetor constant source of trouble, car will not idle properly."—New York freight sales manager.

"Automatic choke trouble, gasoline filters defective, I had to install two."—Illinois pharmacist.

"Have had endless trouble starting the car, and engine stopping while driving."—Wisconsin executive secretary.

"Costly to maintain, have had nothing but trouble with the engine, major tune-up every 2400 miles."—Missouri drive-in operator.

"The first two months that I had T-Bird, it was in garage more than on the road—new rings, bearings, valves ground at 6000 miles."—North Carolina doctor.

"This is the second engine in my car, first one blew up at 6200 miles."—Illinois tree surgeon.

"Great difficulty starting, have had numerous carburetor adjustments."—New Jersey salesman.

"No one can say that he is really satisfied with mileage, however considering size and power and my mode of driving, I think that 12 miles per gallon is all one can expect."—Rhode Island postal employee.

"My lady friend luxuriates in it, but she doesn't buy the gas!—eight miles per gallon!"—New Jersey magazine editor.

"I believe that the engine could be designed to get somewhat better mileage (12-14 reported) and yet preserve the power and pep."—Louisiana geologist.

"Very poor gas mileage."—Pennsylvania pattern maker.

"The craftsmanship isn't what it should be in a prestige car in this price class."—Illinois salesman.

"More care on production line so that it doesn't become necessary to return to dealer to fix nuisances."—New Jersey doctor.

"Too many defective items; spark plug wires, manifold gasket, differential gearing, top control switch, gearshift lever collar."—California engineer.

"T-Bird is kin to the Ford and therefore not well-made."—Texas saleswoman.

"Windshield cracked at 4000 miles."—Ohio chief metallurgist.

"Expensive brake trouble within 5500 miles—master cylinder had to be overhauled."—Ohio office manager.

"Brakes inadequate."—Pennsylvania insurance man.

"Brakes fade very badly, need frequent adjustment, are inadequate for car of T-Bird's weight."—Iowa instructor.

"It has very poor brakes."—California contractor.

Here is the rarest of all men, a realist who is not looking for "something for nothing." →

In respect to some items like glove box, heater controls, wipers, he's right; they are Ford parts at Lincoln prices. →

If car is driven as hard as its power plant and chassis permit it will "outrun" its brakes. →

Now for More Best-Liked Features

The following quotations describe other best-liked features of the Thunderbird ranging from sixth to eleventh in order of frequency.

"Seating is terrific on long hauls."—Illinois salesman.

"Bucket seats provide much comfort for the driver on a long ride."—Massachusetts restaurant manager.

(Continued to page 244)



SATISFACTION GUARANTEED!

EXPERT ENGINE SERVICE

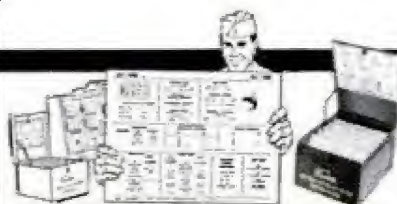
How the Sun Program equips

*car dealers, repair shops, service stations
to render top quality engine repair service*

Your repair job is no better...than the skill of the man who does it...and the precision of the test equipment used...and the training of the technician who makes the tests. That is why the Sun Service System assures all three. This 3 point Sun Program makes it possible for shops using Sun Test Equipment to give you a **GUARANTEED SATISFACTION** engine repair job. Why not drop in and get your car serviced by the repairman who uses Sun Engine Testing Equipment and who displays the "SATISFACTION GUARANTEED" SIGN.



SUN TECHNICIANS...
nearly 300 Sun Men throughout the United States, in clinics and on the job, are daily counseling with mechanics...assisting in the solution of difficult engine repair problems.



SUN TECHNICAL SERVICE...
newest service consists of Sun Flash Cards which tell the mechanic, at a glance, how your engine compares with the car factory specifications for your exact model engine.



SUN SCHOOLS... Sun is famous for its leadership in establishing technical training courses for mechanics to make them masters in the techniques of expert engine testing.

Look for this Sun Sign
on the road...in
your neighborhood.



*This message is sponsored by
Sun Electric Corporation, Chicago, Illinois, on behalf of over
75,000 Car Dealers, Service Shops, Service Stations
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Sun SERVICE SYSTEM

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917

He's right only if you →
limit search to high-price
cars; there are plenty of
sensible-size cars in
low-price field with
more to come.

Amen. →

Here we go again, another
guy who wants his cake
and eats it too. If the
T-Bird were a six-passenger
sedan this man wouldn't
have bought it! →

Yes, indeed. They are hard
for driver to get at, but
an easy reach for in- →
quisitive fingers of
children riding in the
back seat.

Quite so, T-Bird manages
to give the impression →
of first-class travel
without the ostentation
of great bulk.

"Ease of handling, and, it fits in my garage."—New Jersey salesman.

"Cars have been getting too large, T-Bird offers the only escape unless you can tolerate a two-passenger car.—Ohio assistant to president.

"Has the advantages of a compact car yet is heavier with better maneuverability and holds the road better."—Ohio bank president.

"Interior perfect, everything fits in place and upholstery is beautiful."—California mechanic.

"It's a pleasure to drive a car that doesn't take two spaces to park."—Kansas sales manager.

"Nary a squeak or rattle."—New York salesman.

"Sturdy, solid body."—Arizona farmer.

"The feeling of structural solidity."—Maryland salesman.

And Now Some Additional Complaints

Sixth on the list of complaints from T-Bird owners is transmission trouble. Here in the order of frequency are this and other complaints.

"Handshift is hard to operate and clutch seems to be slow to engage."—Virginia clerk.

"Automatic transmission doesn't shift smoothly."—Georgia bottler.

"Rattles under dash, both doors and front seats are loose."—Illinois sausage maker.

"Too many body rattles for a car of this category."—New York dentist.

"The back seat should not have the hump so that three can sit in the back."—California machinist.

"Seats are comfortable, but could stand more length for better leg support."—Michigan mechanic.

"Exterior paint job could be better."—California rancher.

"Paint is so thin in spots that undercoat shows through."—New York architect.

"Small, unlighted glove compartment."—Wisconsin advertising man.

"No trunk, underhood or glove compartment light."—Massachusetts dentist.

"Poor location of power-window control switches."—Indiana owner.

"Blind spot created by wide panel between side and rear window is annoying."—Georgia doctor.

Here Are Some Best-Liked Features

In order of frequency here are quotations from reports describing best-liked items from 13th to 17th.

"Built low with plenty of visibility."—Michigan plastics manufacturer.

"Is very sporty looking, a prestige car."—New York housewife.

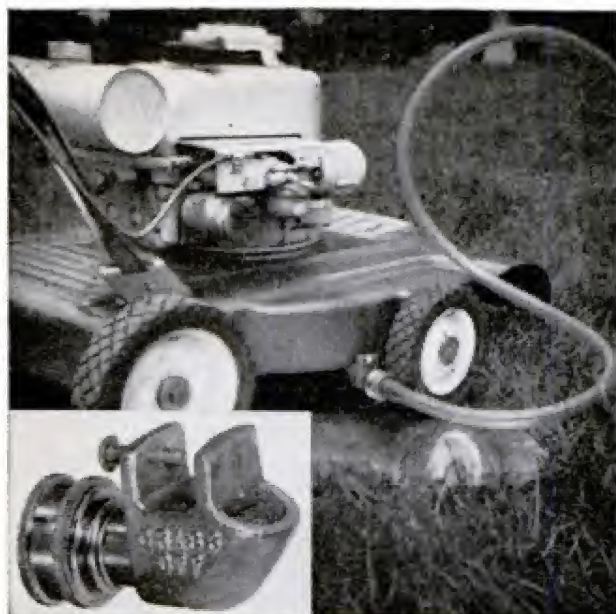
"It is styled right, everyone you pass looks at the car; it gives you a pride of ownership."—Arizona motel manager.

"Performance and the elegant appearance—you feel like a queen. Definitely a prestige car."—Michigan budget analyst.

"I like its low lines."—California director.

"I was promised a new T-Bird each year on trade for about \$500, if this works out cost of ownership will be low and I'll keep on buying 'Birds."—New Jersey doctor.

(Continued to page 246)



Garbark Engineering, Box 114, Broadview, Ill.

Water Jet Cleans Rotary Mower

Grass that sticks to the underside of a rotary power mower is quickly cleaned off by a combination of a jet of water and the turbulence created by the turning blade. Water, supplied by a garden hose, is shot into the housing of the mower through an aluminum fixture that is coupled to the hose and then clamped with a screwdriver to the edge of the housing.

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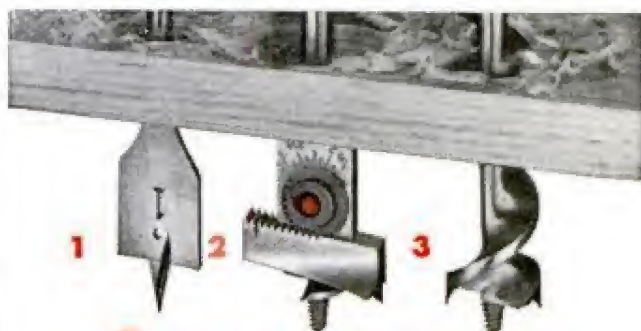
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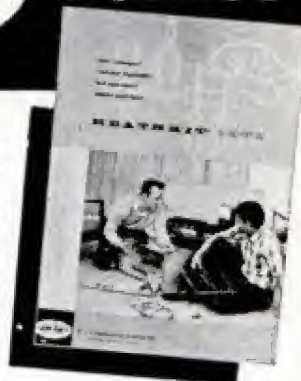
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"Car is extremely quiet at all times."—Minnesota airline mechanic.

And Now Some Final Complaints

Here is a roundup of minor complaints represented by quotations from typical owner reports in order of frequency.

"Wipers are very poor in winter with snow or ice, defroster little use."—New Jersey owner.

"Vacuum wipers unheard of in car of this class."—Illinois electric lineman.

"Shallow trunk space."—New York construction superintendent.

"Not enough trunk space."—Wisconsin salesman.

"Any honest owner of a T-Bird convertible ('60) will admit that luggage space is ridiculous."—Indiana owner.

"Mirror hinders your vision of oncoming vehicles."—Illinois mason.

"Breakdown of carbon core ignition wires."—Texas dairy owner.

"Ignition wiring had to be replaced."—Ohio realtor.

"Engine seems sluggish, doesn't have the pep that I think it should."—Indiana inspector.

"Engine-transmission combination seems sluggish; you really have to hit the throttle to get going."—Missouri housewife.

This wraps up the report on the 1960 Thunderbird as told by owners and based on 2,494,808 miles of driving experience. For a complete summary of the percentages turn back to page 106. ★ ★ ★

It's hard to see why this problem wasn't nipped before it was put into production. →

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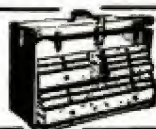
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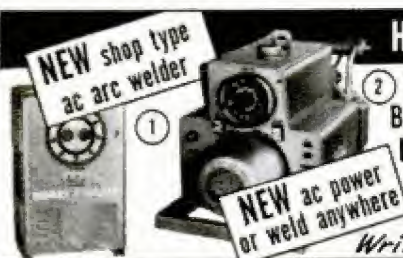
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cept silently to slip meals to him. Frau Schragmuller and her staff kept him under constant surveillance through a wall mirror which was in reality a screen. By the time they set the candidate free there was little that they did not know about him.

Agents go to schools which have more hard knocks in the curriculum than any other schools on earth. They are toughened and conditioned, mentally as well as physically, and taught all sorts of things, from how to operate a fountain-pen gun or incapacitate an auto's engine by putting sugar in the gas tank to how to organize a report. They become chemists versed in secret inks and the composition of exotic explosives.

How to tap a phone, rifle mail, break into a house or blackmail a statesman are all in the curriculum. Agents learn such little tricks as carrying an extra necktie. A man can switch neckties in a hurry and appear to be a different person. Hats also change a man's appearance, but an agent is told that sunglasses favored by writers of spy thrillers merely make a man conspicuous. One thing is cruelly certain. He must learn his lessons well for any gaps in his training increase his chances of failure, not arithmetically but geometrically, as he gets farther and farther into his assignment.

Naturally an agent must have a valid cover. He cannot accomplish much if he gets found out as easily as did a clumsy OSS agent in a neutral country during World War II. Every time he entered his favorite restaurant the orchestra struck up a catchy number called, "Boo! Boo! I'm a Spy." Some jobs naturally make better covers than others. The representative of a Soviet trading corporation or a Red airline employee, for example, are more likely to be spies than a visiting Soviet journalist. A seaman on a Polish ship might be a high-ranking intelligence officer. Whatever his cover, the agent is so comfortable in it that it is not his second nature but his first. Any spy who thinks of himself as a spy is insufficiently prepared for his task. Any spy who thinks himself mysterious and romantic is temperamentally unsuited for his job.

A resilient Britisher, Sir Robert Baden-Powell, who is better known as the founder of the Boy Scouts, was actually one of the great professional spies of this century. Baden-Powell was a master of cover. On one occasion he was assigned the task of getting the caliber of guns in an Austrian fortress on the Dalmatian coast. Instead of hot-footing it to the Adriatic he went back to college to study entomology. He specialized in butterflies. Then one summer he set

out for the Dalmatian coast with carefully prepared notes in his field book together with sketches of the colorful insects which he had learned to do in exquisite detail. He even carried his butterfly net in exactly the way as did his professor. On the Dalmatian coast he was so obviously a British entomologist that authorities paid no attention as he captured butterflies and sketched them in his little book. He happily showed his beautiful drawings to everybody who asked to see them and to many who did not. But into the wings of his butterflies he carefully drew the outlines of the fortress he was sent to map. He went back to London with every scrap of information he had been assigned to get.

An equally patriotic American colonel was less successful. He set out shortly before World War II on a mission similar to Baden-Powell's. The Japs had fortified Jaluit Island in the Pacific, and the colonel, pretending to be interested in flora and fauna, intended to find out how. He fooled nobody. The colonel died a mysterious death and was cremated by the Japanese, who with polite smiles presented the American ambassador in Tokyo with a handsome vase containing his ashes.

Sometimes a whole intelligence apparatus working in a foreign country masquerades behind a cover organization. Recently a former CIA agent bitterly complained to me that a well-known newspaper columnist had blown the cover which he and his friends had been using in Formosa. He was particularly incensed because the columnist himself had served in OSS.

"I should think he would have known better," he grimly observed.

Fortunately for the CIA agents, they were in the good graces of the friendly nation from which they carried on their anti-communist intrigues, and they were able to re-establish their activities under another cover. Such was not the case with a prewar cover firm in Japan, Max Klausen Shokai. Max Klausen was an associate of the notorious Richard Sorge, who was the top Red spy in the Far East. He set up a business in Japan to make printing presses for the production of blue prints. The company made a perfect cover for Communist spies. Moreover, it gave Sorge and Klausen ironic pleasure when their agents stole blue prints from the Japanese army and navy, which had been printed on the equipment their cover firm had sold to them. Max Klausen Shokai was blown as a cover when Sorge was captured and executed. Scores of Red agents were fingered.

Most successful spy nets depend upon

(Continued to page 250)

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disloyal citizens of a country for part-time help. The CIA sometimes employs foreign nationals although it also makes good use of naturalized Americans who can readily pass in their native lands. Because of their distinctive appearance, the Japanese in particular have had to rely upon foreigners to spy for them. This is especially true of their activities in white countries. Such a Japanese spy was the White Russian dancer, Katherine Melikov. She was trained by the unscrupulous Japanese spymaster Kenji Doihara and sent into Siberia to make as good a marriage as she could among the young Communist engineers working for the Soviet Far Eastern Railroad.

Katherine lived up to her mentor's hopes and married a section superintendent. Her husband proved brilliant and was in time transferred to Moscow where he held sway over all Russian railroads. Katherine had fallen deeply in love with her fanatic Red husband, but this did not keep her from continuing to serve Doihara. She hated the Communists far too much to let conjugal love interfere.

Russian security required her husband to leave her behind in Siberia until her antecedents could be properly checked. He lovingly promised to send for her as soon as he could. But Katherine did not wait for the security police to call on her. She left for Japan where Doihara had facial surgeons change her looks. She dyed her blonde hair brunette. With proper proletarian cover in detail, she made her way to Moscow where she got a job in a lamp factory. She worked hard and climbed through Red circles until one day during a party at the home of an engineer her husband entered the room. She calmly chatted a moment with a companion and left without appearing to recognize him.

Germany and Japan were then colleagues in turmoil, and she called upon Nicolai Petrovich, a German agent, to ask his advice. What should she do about her husband? He solved the problem by arranging a train wreck which killed her mate. Now there would be no danger of her being caught. She continued to rise and became secretary of personnel in a Red army bureau. She gave the Reds a dose of their own medicine by placing her subversive friends in important posts. Then one day the secret police arrested her together with Nicolai Petrovich and some 94 other German and Japanese agents. Her husband had indeed recognized her at the party. Since she had not looked him up when she came to Moscow, he realized that she could be up to no good. He reported

her. The police had delayed arrest until they could net as many spies as possible.

Canny agents look far ahead and sometimes plan decades in advance. One such British agent met a kindly old German couple. When he learned that they were staunchly anti-Nazi, he proposed that they set up an inn at the North Sea end of the Kiel Canal. It became the custom for outward-bound German submarines to put in at the inn for a last glass of beer in the fatherland. Following the agent's advice, the couple passed out foaming beer on the house. The agent also had suggested an agreeable custom for officers and men to sign a guest book. Both customs continued on into World War II. As soon as the submarine had put out from the inn, the innkeeper seized the guest book, went to his cellar, and hurried through an underground passage to a nearby house where a British radio operator waited to send details to the Admiralty.

Communications are always a problem for an agent in the field. Much intelligence moves by diplomatic pouch which is normally immune from search. Some is enciphered and sent by radio. Fortunately for a spy, the agent with a transmitter in his suitcase is a thing of the past. Thanks to transistors, he is now able to slip his equipment into his pocket. But radio is still a dangerous means of communication, for counter-espionage has little trouble in locating an unauthorized transmitter through triangulation.

Sometimes information is microphotographed. The tiny film as small as the head of a pin is stuck to a letter or postcard and mailed to a neutral country, from which, in due course, it finds its way to headquarters. During Hitler's day German steamship lines were known as the "bridge of spies" because of the flow of information they carried back to Germany. In this air age, airliners have taken over the job of ferrying secret couriers across the oceans with their contraband information.

Finally, both the open and secret intelligence from the field reaches the map room or the situation room as it is sometimes called. There the analysts study it and compare it with information from other sources. There it is compiled into reports and brought to the attention of the nation's leaders. After all the drudgery and danger of gathering intelligence, it galls an intelligence organization, from the spy in the foreign capital to the director at home, when their most urgent and accurate reports are ignored. Russian intelligence must have felt particularly frus-

trated when in 1941 Stalin would not believe conclusive evidence that Germany was about to attack Russia. He refused to take precautionary defense measures and as a result his armies were hurled back all along the frontier.

On the other hand, British agents had cause for satisfaction when they turned in reports gleaned in Greece by infiltrating the Greek communist party. They learned that the Russians were going to strike at both Greece and Turkey. In March, 1947, British leaders alerted Washington to the imminent invasion and admitted that British strength was not sufficient to prevent it. President Truman announced the Truman Doctrine and frightened the Reds off. Both British and American leaders acted swiftly and decisively on intelligence reports. Peace was preserved.

This underlines the fact that intelligence need not serve the cause of war. It serves only to inform policy-making national leaders of the plans and potentials of other nations. Wise leaders will make wise use of intelligence to keep the peace. ★ ★ ★

Movable-Wing Plane

(Continued from Page 90)

Artist G. H. Davis recently visited Dr. Wallis and sketched development steps and projected concepts of the unusual plane, which has backing by the British and U.S. governments; those sketches appear in these pages.

One problem posed in planning a large supersonic plane—Dr. Barnes is making a design study for a 50-ton airliner—is that a long fuselage and swept-back wings would demand landing gear too long to be functional. Dr. Barnes therefore fashioned a variable-geometry plane with a wing comparable to the delta wing except its center portion is missing. The wing can be pivoted forward for takeoff and landing—giving it a wingspread of some 130 feet, or a spread as wide as the plane is long—and tucked back, like tail feathers, to give the configuration necessary for faster-than-sound flight.

The plane should be able to takeoff after a run of 200 or 300 yards at 100 miles an hour ground speed. The four engines, placed in pairs above and under each wing, can swivel from side to side; they also can pitch up or down. So they are to be the elevators and rudders of this remarkable plane which may be the first to have movable wings that will be of real help to man in achieving his age-old desire to soar into the sky. ★ ★ ★

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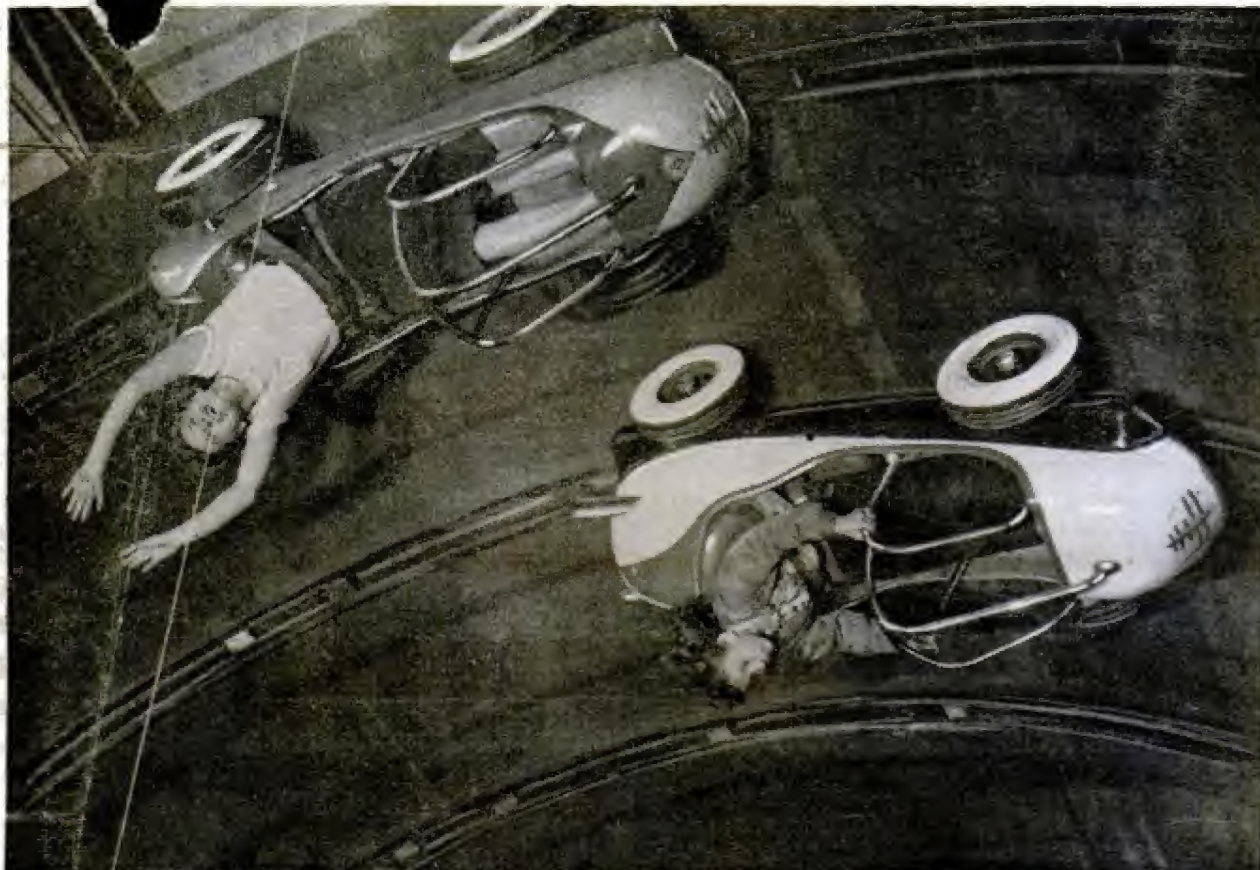
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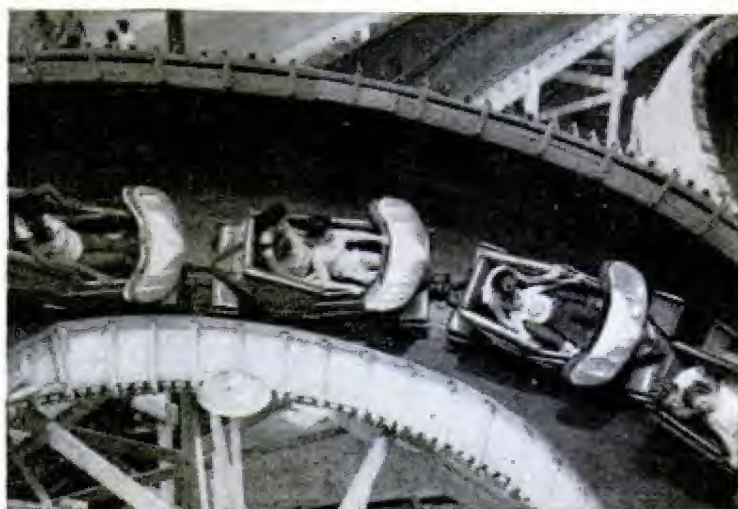
DIZZY WHIRL

By Robert A. Kelly

AMUSEMENT PARKS, like everything else, are changing with the times. There are still enough of the old favorites—the roller coasters, octopi, looping planes and snap-the-whips—to go around, but the park managers and their ride manufacturers are always looking for new ways to scare you as badly as possible without actually placing you in danger of bodily harm.

Armed with their favorite tools—centrifugal force, big (but safe) bumps, and seemingly-precarious heights—they're spinning and bumping and hoisting their customers faster and harder and higher than ever before.

The first rule of successful ride design (and amusement park management) is to scare you at first, but convince you as quickly as possible that there's really no danger. They know you'll come back again and again, whether it's to relive the thrill of the ride, to take someone else through it, or just to prove that it doesn't *really* scare you, even if it does.



♦ At Chicago's Riverview Park, the Flying Cars spin inside a rotating cylinder on steel tracks. By operating a footbrake, the driver can go up and over inside the cylinder at any speed

Latest variation on the Ferris ♦ wheel is the Space Wheel built by Allen Herschel Co. for Pacific Ocean Park in Los Angeles, Calif. Entire structure rotates while the small wheels turn separately

♦ Principle of the big bump goes aquatic at Riverview with their Water Bug. Two passengers ride inside a huge rubber tube boat which is free-running and self-propelled. Note padded cockpits



Perhaps the dizziest whirl is ♦ on the Round-Up built by Frank Hrubetz Co. The wheel turns at high speed, then rises as shown. Riders on top seem to hang suspended, held by centrifugal force



♦ Flying Turns ride at Riverview combines a bobsled run with a roller coaster, with trains of cars racing on a shaped track. This park's rides are designed and built by their own staff



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Fifty-nine white rats sat in for one man
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ciation, the rats were placed in a 100-cubic-
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HE JUST DOESN'T HAVE IT!



I OVERHEARD THE BOSS TALKING ABOUT ME—FRANK SMITH! THE WORDS HURT. BUT DEEP DOWN I KNEW THEY WERE TRUE.

I'D WATCHED OTHER YOUNGER MEN MOVING AHEAD, GETTING RAISES...THE GOOD JOBS. WHY WAS I BEING LEFT BEHIND?

GEE—ANOTHER PROMOTION, JIM? CONGRATULATIONS!



THANKS, FRANK. SORRY YOU'RE NOT COMING ALONG, TOO.

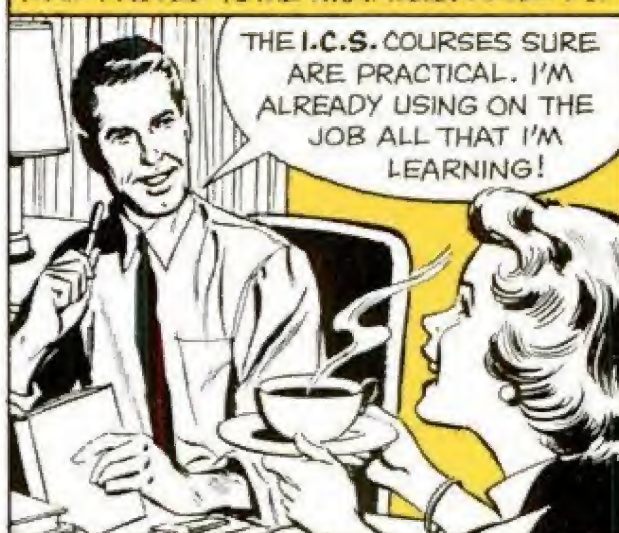
THAT NIGHT I FELT DESPERATE. THEN MY WIFE SAID SOMETHING THAT CHANGED MY WHOLE LIFE!



REMEMBER THAT INTERNATIONAL CORRESPONDENCE SCHOOL'S ADVERTISEMENT YOU SAW THE OTHER DAY? I SAVED IT FOR YOU.

SAY! THAT'S AN IDEA—MAYBE I.C.S. CAN GIVE ME THE JOB TRAINING I NEED TO GET AHEAD!

I MAILED THE I.C.S. COUPON. THE FREE CAREER KIT I.C.S. SENT ME BY RETURN MAIL PROVED TO ME WHAT I.C.S. COULD DO.



THE I.C.S. COURSES SURE ARE PRACTICAL. I'M ALREADY USING ON THE JOB ALL THAT I'M LEARNING!

THE BOSS HEARD ABOUT MY I.C.S. COURSE. AFTER THREE MONTHS I GOT A GOOD RAISE—AND A LITTLE LATER...



I GUESS I WAS WRONG, FRANK. YOU'VE GOT WHAT IT TAKES. WE'RE GIVING YOU A PROMOTION. YOU EARNED IT, AND THE WAY YOU'RE GOING THERE'LL BE ANOTHER RAISE SOON!

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